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TEACHERS' PERCEPTIONS OF THE AUDITORY DISCRIMINATION, LISTENING AND VERBAL COMPREHENSION SKILLS OF CHILDREN WHO FAIL SPEECH AND LANGUAGE ASSESSMENT

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Abstract

The link between children's auditory discrimination ability and their language and literacy development is the subject of much debate in the literature, as is the relationship between auditory discrimination and attention. As a professional group in daily contact with children, teachers have been demonstrated as generally reliable predictors of their pupils' performance in many language-related domains. Are teachers able to identify their pupils' difficulties with auditory discrimination?

A questionnaire was administered with teachers in West Sussex, England, relating to those of their four-year old pupils who had failed a speech and language screening assessment. The questionnaire explored the attention, listening and comprehension abilities of the child and presence of any difficulties in these areas and included a question on auditory discrimination. The research was part of a larger project 'Listening to Speech' that aims to evaluate the effectiveness of a Speech & Language Therapy (SLT) programme for groups of children in their first year at school that improves their speech discrimination, listening and attention skills.

Correlation was measured between teachers' ratings of attentive listening, verbal comprehension and auditory discrimination abilities and formal speech and language test results.

Results showed significant correlation between teacher ratings and children's test scores in the domain of verbal comprehension. There was also significant correlation between teachers' ratings of children's attentive listening and performance on verbal comprehension tests. However there was no significant correlation between teacher ratings and children's test scores on auditory discrimination. The questionnaire's internal consistency was measured, and found to be reliable overall, but poor as a measure of auditory discrimination specifically. Possible reasons for this, including potential problems with questionnaire design and assessment test, are discussed.

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Introduction

Auditory discrimination can be described as the human brain's processing and recognition of incoming speech signals. Effectively it allows the hearer to differentiate between two sounds that may contrast only by minimal acoustic elements, such as those in the words 'pin' and 'bin' or 'ship' and 'chip'. Difficulty with auditory discrimination therefore manifests itself as an inability to discriminate between certain speech sounds and as such can have broad and far-reaching effects on children's functional language. A young child may pass a routine hearing test, but struggle to detect differences between certain speech sounds or pitch changes. This is thought to lead, in some children, to listening, receptive and expressive language and literacy problems (e.g., Jerger & Musiek, 2000; Serniclaes, Sprenger-Charolsses, Carre & Demonet 2001; Tallal, 2000; Reed, 1989).

In the UK, awareness of children's problems in this area is largely limited to audiologists and speech and language therapists (SLTs). SLTs are familiar with the concept largely through the 'psycholinguistic processing' model devised by Stackhouse and Wells (1997), which emphasises the role of auditory discrimination in the input processing of language. In the United States it has greater recognition as a factor in children's language development, under the mantle of the diagnosis of '(central) auditory processing disorder' or (C)APD. However this recognition brings with it increased controversy, not least over the terminology used to describe the disorder. Auditory processing disorder is merely a description of symptoms of functional deficits in one or more of the following behaviours: "*sound localization and lateralization; auditory discrimination; auditory pattern recognition; temporal aspects of audition including temporal resolution, temporal masking, temporal integration, temporal ordering; auditory performance decrements with competing and/or degraded acoustic signals.*" (American Speech and Hearing Association, 1996, p.47). Even in the UK terminology varies, including 'speech discrimination', 'speech input processing'. This study will use the term 'auditory discrimination'.

There are no reliable estimates of prevalence of auditory discrimination problems in the UK. In the USA, CAPD is estimated to occur in 2 to 3% of children, with a 2-to-1 ratio of boys to girls (Chermak and Musiek 1997).

Comorbidity of auditory discrimination problems

It appears there is a close relationship between language, attention, and auditory skills. Auditory processing disorders often – but not always - coexist with learning disabilities, language disorders, attention deficit disorders, and dyslexia (e.g., Chermak & Musiek, 1997; Cacace and MacFarland, 1998). The fact that not all these groups of children can be demonstrated to have auditory discrimination problems (e.g., Bailey and Snowling 2002), has led some investigators to question if auditory processing deficits do in fact underlie language disorders, or if auditory processing disorders are but one type of language disorder (see Chermak & Musiek, 1997 for a summary of the debate).

Links with language problems

Children's auditory discrimination is known to be less efficient than adults'; this may be attributable to a combination of '*maturational differences in neural and linguistic development and response strategies, as well as peripheral processing differences'* (Chermak, 1997, p.47). However researchers have found links between infants' auditory behaviour and their subsequent language development (e.g., Tsao et al 2004; Ward 1984). In their longitudinal study of normal children, Tsao et al (2004) found significant correlations between babies' speech perception ability at 6 months and expressive language at 2 years (on measures of word understanding and production, phrase understanding). Vance's (2001) longitudinal study of normal children aged 4-5 years examined relationships between speech discrimination and production skills, short-term memory & language. The findings suggested that speech discrimination skills were the most significant factor in subsequent language development.

Research with children with specific language impairment (SLI) has identified a range of possible underlying causes of this condition, including deficits in discriminating the temporal order of rapid sequences of auditory signals (Tallal 2000), and elevated thresholds for frequency discrimination (McArthur and Bishop 2004).

Links with literacy problems

Similarly, many researchers have sought to establish a link between speech processing and phonological skills and learning to read and spell (Snowling 2000; Goswami & Bryant, 1990; Reed 1989). As Snowling (2000) explains *'..the phonological deficits*

associated with dyslexia extend beyond the ability to reflect on the sound structure of words (phonological awareness) and encompass subtle impairments of speech perception and production, limitations of phonological memory, naming deficits and verbal learning difficulties' (p43). Tallal's (2000) temporal order theory proposes a possible cause of auditory discrimination problems: those children who segment speech in larger time chunks will have problems with isolating the fine phonetic units that account for the phonological skills that are necessary for oral language development and for establishing letter-to-sound correspondence when learning to read.

However Bailey and Snowling's review of the literature (2002) warns that the evidence of a link between basic auditory processing impairments and SLI and dyslexia is inconsistent. Methodological problems of frequent uncontrolled group differences in experimental studies are held partially to blame, plus theoretical issues such as a lack of agreement regarding the relationship between basic auditory skills, speech perception and phonological processing abilities.

Links with attention problems

It seems beyond question that attention is essential to higher level processing, and poor attention can compromise listening. Chermak and Musiek's review of the literature (1997) notes that CAPD, learning disabilities and attention deficit disorder have *'similar performance-deficit profiles, which include inattention, poor listening skills, distractibility, inappropriate social behaviours and poor academic achievement'.*

Riccio and Hind (1996) reported, in their review of the literature, that children with ADHD demonstrate significant difficulty on tasks used to assess central auditory processing skills. However Norrelgen (1999) found no difference on a test of speech discrimination between controls and children with ADHD and children with ADHD plus motor problems. Norrelgen commented that, given the children's mean age of 11:02 years, it could be that language-impaired children have speech discrimination delay at an earlier age that resolves with maturation. In the same study, on a test of phonological working memory Norrelgen did find significant differences between control and ADHD+ groups (but not between control and ADHD-only groups).

To date it remains unclear whether CAPD and attention deficit hyperactive disorder (ADHD) are part of a single developmental disorder or whether auditory processing deficits among children with ADHD may simply indicate the co-occurrence of CAPD. Controversy equally persists over the question of causality: whether it is an inability to focus sufficient attention on auditory stimuli that causes auditory processing deficits, or whether deficient auditory processing impairs attention.

In summary, a subset of children with language, learning and reading impairments have auditory discrimination deficits compared to their unimpaired peers. However, as Bradlow, Kraus and Hayes (2003) comment, the mechanism that underlies the impairment has yet to be fully explained.

Difficulty discriminating speech in noise

Research has shown that children with language impairments have significantly higher speech recognition thresholds in noisy environments than children without language impairments (e.g., Elliot, Connors, Kille, Levin, Ball & Katz, 1979; Stollman, Kapteyn & Sleeswijk, 1994). In addition, Geffner, Lucker and Koch (1996) compared the auditory discrimination ability of children with attention deficit disorder (ADD) with a control group. They found no differences between the groups in quiet conditions, but significantly poorer performance by the ADD children in noisy conditions.

In fact there is increasing recognition of the impact of noisy environments on the academic performance of *all* children. A recent Department of Health project (Shield & Dockrell, 2002) found that increased noise levels (both noise within the classroom and external environmental noises) negatively influenced pupils' scores on reading and spelling tests. The scores of children with special educational needs were particularly affected. In contrast, Bradlow, Kraus and Hayes (2003) counter that the evidence in this area is as yet unreliable for children with learning disabilities such as dyslexia, with insufficient studies that use both sentence-length utterances and school-age participants.

The debate notwithstanding, it would seem logical that, if all children appear to be disadvantaged by noisy environments, then those with a problem with identifying speech in noise will be doubly affected.

Detection of language problems in childhood

About 5-8% of children under the age of five have developmental impairments of speech and language; a higher proportion than for any other neurodevelopmental condition occurring at that age (Drillien & Drummond, 1983). In children in whom language impairment has persisted beyond age five, longitudinal research has demonstrated significant ongoing effects into adolescence, in all aspects of spoken and written language ability (e.g., Stothard, Snowling, Bishop, Chipchase & Kaplan 1998; Beitchman, Wilson, Brownlie, Walters & Lancee, 1996). Beitchman et al argue for the urgent need for early intervention, as it follows that these consequences can be reduced if language skills can be improved at an early age. Research has suggested that children whose speech and language problems are going to spontaneously resolve, will do so by age four (e.g., Law, Boyle, Harris, Harkness & Nye, 1998). Hence by the beginning of these children's school careers, more persistent language difficulties may be more reliably identified and intervention commenced, in an attempt to reduce the longer-term effects on educational and social development. However, there is no standardised approach to identification of at-risk children in the UK. Extensive formal assessment is not cost-effective; it requires SLTs and/or other trained staff in schools and takes substantial time per child.

Screening children, to identify those who require further in-depth assessment of their language, is an alternative. However there are still not enough SLTs to screen every child - SLT services are known to vary greatly in size and in SLT:child ratio, with an average of one SLT to every 4,257 children (Lindsay, Soloff, Law, Band, Peacey, Gascoigne, & Radford, 2002). Nor is the choice of the definitive screening instrument clear. Although general language screening tools are widely available, and it is difficult to make judgements about the relative value of different procedures given that few studies compare the performance of two or more screening tests across one or more populations (Law et al,1998).

Crucially, at a policy level there is as yet insufficient evidence to merit the introduction of 'universal' speech and language screening. Law et al's (1998) review of the literature on childhood screening concluded that '*In general, specificity is higher than sensitivity, suggesting that it is easier to determine who is <u>not</u> a case than to establish who is*'.

However the authors recommend that speech and language delay should continue to be identified, but perhaps by *'less formal methods'*. One such method is to involve teachers.

Teacher involvement in identifying language problems

Primary school teachers have responsibility for large numbers of pupils, with a national average of 26.2 children to a class and 12.2% of classes with 31 or more pupils (Department for Education and Skills, 2005). Nonetheless, over time teachers are able to observe their pupils in a range of contexts. As professionals, teachers have the potential to contribute greatly to the process of language screening (i.e. prioritising children for more in-depth SLT assessment). Teacher involvement in this process has been variously advocated (Fujiki & Brinton 1984, Patterson & Wright 1990, Whitworth et al 1993), although it is not without drawbacks. It places a further training and monitoring requirement on professionals who already have heavy workloads. Furthermore commentators disagree over the accuracy of teacher 'diagnosis' and whether it is as effective as test-based assessments. It is clearly important to determine whether teacher-based screening is actually as (or more) accurate and effective as speech and language assessment.

It appears that teachers are able to identify a range of classroom behaviours that reflect listening, language comprehension and expression and literacy. Research has been conducted with teachers into many domains relating to their pupils' ability; those relevant to this review include cognitive measures, preferences and traits (Miller and David, 1992), pragmatic language (Bishop and Baird, 2001), ADHD (Guerts et al 2001; Weller et al 1999), reading failure (Bates and Nettelbeck 2001), social/behavioural (Botting and Conti-Ramsden 2000), general academic ability (Hoge and Coladarci, 1989; Fuller 2000; Kenny and Chekaluk 1993) and hearing impairment (Hind 1999). In these studies, teacher opinions were variously compared with test results, parents' views and in some cases, Speech and Language Therapists' conclusions. All these studies reported that teachers were moderately- to- strongly accurate predictors of a range of problems in their pupils. Algozzine and Ysseldyke (1986) even found teachers to be better predictors of success or failure in school than screening instruments or test batteries.

In Australia, Whitworth, Davies, Stokes and Blain (1993) developed and trialled a criterion-referenced Teacher Checklist for use by preschool teachers to identify speech and language impairments in their pupils. The Checklist included nine sections, with examples provided of behaviours that would be seen in children who were 'age appropriate', had 'mild' or 'moderate or severe' difficulties. For example, the profile of a child with 'moderate-severe difficulties in understanding' included 'usually has difficulty following instructions; does not ask for clarification when failing to understand; poor listening skills'. Auditory discrimination skills were not specifically included. The results showed that the level of agreement between teachers and SLTs in the identification of moderate-to-severe cases was higher than the parent-SLT agreement (76.2% versus 66.1%). Teachers also had a lower over-referral rate than parents.

Boynton Hauerwas and Addison Stone (2000) found a moderate correlation between teachers' ratings and the test scores of SLI children on an expressive language test ($r=0.55$), but they found no significant correlation with the same children's scores on an auditory comprehension test. Nor did the teachers' ratings significantly correlate with the language test scores of controls.

In a search of the literature, no existing research was found that directly explores teachers' ability to identify auditory discrimination. Research into reading skills often explores phonological awareness (which is itself dependent on good auditory discrimination). Flynn and Rahbar 1998) compared the success of a new screening battery with teacher ratings in predicting children at risk of reading failure. Kindergarten teachers achieved low positive identification rates (30%) when asked to predict future reading achievement using a traditional rating scale, while the new screening battery correctly identified 81% of poor readers. Combining test results and teacher ratings resulted in 88% identification of those who failed in the first three years of school. Both instruments included items on receptive vocabulary, the screening test included a section on phonemic segmentation of sounds, and the teacher scale explored, amongst other parameters, children's knowledge of rhyming and letter sounds, but neither specifically explored auditory discrimination.

Various commentators (e.g., Perry & Meisels, 1996), have expressed concern about the consistency of teachers' assessments. Areas under scrutiny include variability between

teachers, an inherent subjectivity (due to the influence of expectations and biases), and whether teachers have enough specific knowledge to judge children's performance in certain domains.

The problem with rating scales

Of course reliability issues with teacher ratings may reside with the rating instruments themselves. In a critical evaluation of norm-referenced assessments, questionnaires and language samples, Dockrell (2001) advised that screening tests designed to identify the presence of a *current* language problem are far from 100% accurate, with ongoing debate between specificity and sensitivity. Certainly any *predictive* ability remains unproven (e.g., Dockrell, 2001; Kenny & Chekaluk, 1993),

Given the concerns about teacher reliability in identifying general language problems and the lack of simple, reliable assessment tools, it has been suggested that the reliability of assessments can only be improved by taking multiple measures of early language skills and combining them with the expertise of different professionals (eg. Flynn & Rahbar, 1998; Dockrell, 2001). However, given that auditory discrimination ability is just one parameter implicated in language development, must the same rules apply, or can auditory discrimination be reliably identified through a teacher rating scale?

Teachers' familiarity with auditory discrimination

The UK Government has put in place measures to identify children at risk of reading failure; through the Primary National Strategy, which supersedes the National Literacy Strategy. Teachers of Foundation year children (ages 4-5, formerly known as Reception class) are required to draw on their ongoing observations and assessments of each child when completing a Foundation stage profile handbook (Department for Education and Skills, 2003) for each pupil at the end of the year. Items on the assessment scales include 'sustains attentive listening', 'listens and responds' and reflect the current emphasis on "phonics"; 'hears and says initial and final sounds in words', 'hears and says short vowel sounds within words'. This ensures that children at risk of educational failure (i.e. as having special educational needs) are identified early.

Although the handbook asks about the child's ability to '*hear*...initial and final sounds in words' as well as say them, teachers are not required to test for this receptive ability and

it is addressed only fleetingly in the phonics teaching approach. Hence the statutory approach may be more effective at identifying a *symptom (*poor phonological awareness) than pinpointing one of the possible *causes*: poor auditory discrimination. However, for the purposes of this study reception class teachers can be assumed to be familiar with the *concept* of auditory discrimination through materials available to teachers such as 'Curriculum guidance for the Foundation stage (DfES, 2000).

The difficulty with testing the auditory discrimination ability of children under five is firstly ensuring they understand the task requirements (e.g.,'Tell me if these sounds are the same or different', 'Which one said the same as him?') and even the concepts involved Concanon, 1996, Horan 2003). Children from the age of three have been shown to be able to judge whether the name of a pictured item is said correctly or not (ie. whether the spoken stimuli 'hat' matches the picture of the hat), but even some six year old children struggle with the concept of the 'non-word ABX' task, which requires the child to identify which of two puppet or cartoon characters has correctly repeated a target word (Vance (1996).

The published auditory discrimination tests (e.g.,Auditory Discrimination and Attention Test (MorganBarry, 1988) or Wepman's Auditory Discrimination Test (Wepman and Reynolds, 1987) are not sufficiently brief screening tests to be appropriate for use by teachers and remain the domain of SLTs. Equally, audiologists use behavioural tests which are not suitable for everyday, functional use. However if a simple screening tool used by teachers could be shown to accurately identify auditory discrimination problems, this could improve the targeting of scarce SLT resources when conducting the more in-depth language assessments.

Study questions and hypotheses

This study looks at whether results from a teacher questionnaire reflect difficulties with auditory discrimination and verbal comprehension that have been identified through assessment. In addition the study compares teachers' questionnaire ratings of children's attentive listening with ratings of verbal comprehension and auditory discrimination and test scores, to further investigate the link between attention and auditory processing difficulties. Furthermore, both the questionnaire and one of the

assessments explore children's ability to discriminate speech in noisy and quiet conditions.

Hence the main experimental hypotheses are as follows:

1. Attentive listening and verbal comprehension teacher questionnaire ratings will be significantly correlated with verbal comprehension assessment scores.
2. Attentive listening teacher questionnaire ratings (generally and in noise in particular) will be significantly correlated with auditory discrimination assessment scores in noise and in quiet.
3. Teacher questionnaire ratings for auditory discrimination will be significantly correlated with auditory discrimination assessment scores in noise and in quiet.

In addition the analysis will assess the internal consistency of the questionnaire used in two ways: – within sub-sections (or domains) and across the domains. Hence the supplementary hypotheses are as follows:

Within domains:
4. Teachers will give significantly higher ratings for attentive listening in one-to-one situations than in groups or class discussion.
5. Teachers will give significantly higher ratings for attentive listening in quiet situations than in noisy situations.
6. Teachers will give significantly higher ratings for understanding basic instructions than complex instructions.

Across domains:
7. Teacher ratings of attentive listening in class will be significantly correlated with attentive listening in noise.
8. Teacher ratings of attentive listening in one-to-one situations will be significantly correlated with attentive listening in quiet environments generally.
9. Teacher ratings of attentive listening in noise will be significantly correlated with ratings of auditory discrimination.
10. Teacher ratings of attentive listening will be correlated with ratings of verbal comprehension.

Method

The present study functioned within a larger study 'Listening to Speech' which aims to implement and evaluate an intervention programme designed to develop children's speech discrimination, listening and attention skills.

Design of the present study

The experiment in this study had a correlational design; the variables to be compared were children's scores on two different speech and language assessments and on a teacher questionnaire.

Participants

The Listening to Speech study recruited an initial cohort of 307 children in reception classes in ten mainstream primary schools (ie. with birthdays between 1/9/1999 and 31/8/2000), via a speech and language assessment battery. The schools were mainstream primary or infant schools in the western area of the West Sussex Local Education Authority, representing a range of town and village settings. Schools were of different sizes (one, two and three form entry), and in areas with different socio-economic status demographics, measured according to percentage of children receiving free school meals. There were no exclusion criteria. Information letters and consent forms were sent to all parents (see Appendices A and B). Consent was received for 78% of these children, all these children were assessed. None of the children were known to the researchers.

In each school the four or eight children (depending on size of school) who demonstrated the weakest profile across two of the assessments (SIPc and CELF-P subtest 'Linguistic Concepts') were selected for the Listening to Speech intervention programme (and the present study). These children were mostly performing at chance level on SIPc (i.e. raw score in quiet below 20) and/or had a standard score of four or less (more than -1.5 standard deviations below the mean) on CELF-P. This process resulted in 52 children being selected as having weak speech discrimination and/or verbal comprehension.

- The child participants in the present study were the 52 children who had been selected for the Listening to Speech intervention programme.

- The teacher participants in the present study were the teachers of the child participants.

Materials

Speech and Language Assessments

The assessment battery consisted of four tests:

1) *Speech Input Processing in Children* (SIPc):. (Vance, Rosen & Coleman, unpublished)

2) 'Linguistic Concepts' section of *Clinical Evaluation of Language Fundamentals (pre-school)* – (CELF-P) (Wiig, Secord and Semel, 2000);

3) *Renfew Action Picture Test* (RAPT) (Renfrew, 1997)

4) *Children's Test of Non-Word Repetition* (CNRep) (Gathercole and Baddeley, 1996).

The first two assessments are of particular relevance to the present study and are further outlined below.

1) Speech Input Processing in Children (SIPc) is a computer-based assessment of speech discrimination skills (see Figure 1). The child completes four similar tasks in which they hear nonsense words through headphones and click on a picture on the computer screen. Two of the tasks are accompanied by background multi-talker babble. Computer presentation of the tasks, using headphones, was chosen because it *'allows for more standard conditions of presenting speech stimuli, and enhances the child's attention to the task'.'*(Listening to Speech' website*)*. SIPc uses the 'XAB' presentation format: the child sees three cartoon 'spaceships' on the screen. One 'alien' appears in the top spaceship and says the target non-word, followed by a second and third alien in the respective remaining spaceships, one of which either repeats the target word and the other says a distractor word. The child has to select the alien who repeated the first alien's non-word.

The child's responses are recorded electronically and presented as scores (two sets of 'noise' results, two sets of 'quiet' results). Different non-word stimuli pairs were used in the practice block and in the subsequent test blocks (see Appendix C).

This test has been used to date on 105 children with a mean age of five years (Vance, Rosen & Coleman, unpublished).

Figure 1 Speech Input Processing in Children test

2) In the Linguistic Concepts test (CELF-P), the child hears a phrase and is asked to point to the corresponding picture from a display of three pictures. The assessment explores the subject's comprehension of linguistic concepts and no expressive language is elicited. The child's responses are recorded on a checklist.

Teacher questionnaire

Within the context of the intervention programme, the questionnaire results were to be used as a baseline measure, and will be repeated to contribute to the monitoring of progress after each stage of the intervention programme and the ultimate evaluation of outcomes.

Hence the questionnaire was constructed to investigate teachers' perceptions of 1) the attentive listening and 2) language comprehension abilities of the targeted children, including auditory discrimination. The questionnaire appears as appendix D.

A range of source documents were examined to guide the design, structure, wording of questions, to identify any precedent for the chosen rating scale and to ensure inclusion of concepts and terminology familiar to teachers. For example, current Department of

Education and Skills guidance for schools was accessed, namely QCA descriptors for English: Listening (P-scales) and the Foundation Stage Profile Handbook (2003).

A number of key features were considered in designing the questionnaire (Oppenheim, 1996). Of paramount importance were brevity (no longer than one page) and ease of completion, given the immense pressure on teachers' time and importance of sustaining their goodwill towards the intervention programme. The questionnaire items were composed of closed-ended statements with ordered choices in the form of attitude scales. Although this format restricts the respondent, it reduces completion time and is an effective means of gathering broad sets of opinions.

Attention was also paid to layout and aesthetics, with the content balanced on the page, sufficient space left between items, and possible choices and progression through questionnaire clearly signposted.

Attitude scales for each item in the questionnaire were developed following the 'Likert' scale approach. This is a widely-used means of eliciting reliable, if rough, measures of attitude and, because each item grades a single dimension of behaviour, it is well-suited to statistical analysis (Oppenheim, 1996). Traditionally an odd number of categories – 5 or 7 - is used (eg. 'strongly disagree', 'somewhat disagree', 'neutral', 'somewhat agree', 'strongly agree'), however some commentators prefer a four-point scale to prevent respondents allocating 'neutral' scores. Items and their corresponding scales were designed for uni-dimensionality (ie. measuring one thing at a time) and linearity (ie. equal or equal-appearing intervals). Criticism of this type of approach includes lack of reproducibility; for example, a total score of 10 could be obtained in more than one way, therefore two identical scores could have different meanings (Oppenheim, 1996).

Teachers were asked to report each child's ability *in comparison to his/her peers,* with the intention that this would give them the notion of considering whether each child was 'average for age'. A potential drawback of this approach is the risk of subjective judgements and variability between respondents and classes.

The final questionnaire contained eight items with four- or five- point response categories, including provision for 'don't know'. Respondents were expected to answer all items.

For each item, respondents were asked to tick the position that most closely corresponded with their perception of the child's ability. In all cases, the penultimate position at the right side of the page was the highest scored.

The first five items explored attention and listening. Four response categories were chosen to represent the teacher's perception of the child's level of ability for that parameter:

Well below average	Below average	Average	Above average	Don't know

In the case of attentive listening, it was felt that either a child is judged to have age-appropriate skills, or there is some degree of difficulty. Therefore fewer categories were made available above 'average' than below.

A similar approach was taken with the parameters relating to the child's comprehension ability; either the child's comprehension is considered to be developmentally-appropriate (and four-year old children should be able to understand complex instructions within a classroom environment) or there is some degree of difficulty.

Accordingly the second and third rating scales were reached:

Would not understand	Would require repetition to understand	Would understand	Don't know

The final item specifically investigated teachers' perceptions of the children's auditory discrimination ability, asking about the child's ability to perceive words accurately. The wording chosen was felt to convey the concept best out of the alternatives considered, which included 'Discriminating between sounds in words...' and 'Understanding the difference between similar sounding words...' The corresponding attitude scale was

then constructed accordingly, ranging from often misperceives' to suggest some difficulty to 'never misperceives':

Often misperceives	Sometimes misperceives	Never misperceives	Don't know

Procedure

Speech and Language assessments

The data was collected by nine researchers. Each child was collected from the classroom individually and testing took place in a separate room. To counter-balance for fatigue effects, the four assessments were presented in different orders with different children. The child's responses on RAPT, CNRep and CELF were recorded manually in accordance with the published procedure. Responses on SIPc were recorded automatically by the computer package.

SIPc

When administering SIPc, the child was first asked whether they were familiar with using a mouse. A mouse-familiarisation exercise was available on the software package, whereby the child clicked on a jumping cartoon baby, with positive visual and auditory reinforcement in the form of balloons and laughter on-screen. A practice block was then used prior to the main testing, where the child listened for the XAB sounds, used the mouse to click on his/her choice and received auditory feedback as to the accuracy of his/her decision. After the practice block, the feedback to the child was removed. The main test consisted of the two blocks of 'normal' and two blocks of 'noisy', presented in different orders across children. The repetition and counterbalancing increased the validity of the data and reduced fatigue effects.

The researcher was responsible for choosing each block in the order specified on individual printed score sheets. The computer electronically calculated the child's scores on each block, which the researcher later retrieved and entered onto the score sheet.

If the child was not able to master the use of the mouse, the child was asked to point to his/her choice and the tester clicked the mouse on his/her behalf.

Teacher questionnaire

On entry to the Listening to Speech programme, each child was assigned a personal anonymous numerical identifier, with an additional identifier for each school. The child's gender and age in months at start of study were also recorded. All data was stored under these identifiers, with the Listening to Speech project director holding the only copy linking each child to its identifiers.

Before distributing the questionnaires to the teachers of the 52 child participants (see below), the project director added a child's name to each questionnaire. The teachers of the respective pupils completed the questionnaires anonymously and returned them. On receipt of the completed questionnaires, the project director deleted the children's names and replaced them with the respective child's identifier. Hence the author saw only the identifiers and the anonymity of both child participants and teachers was preserved.

The questionnaires were distributed by hand by the Project Director to the relevant teachers in person or via the School Office, three months after the assessments had taken place. The questionnaires were presented as concerning 'some of the children' and no formal link was made to children who had performed poorly on assessment(s) and were entering the Listening to Speech programme. However it is possible that some or all of the teachers may have made that connection. (Teachers were not advised at the time of assessment which children had failed or passed which assessments, although by the time the questionnaires were distributed most were aware which children would be participating in the Listening to Speech programme).

For analysis purposes, all items on the questionnaire carried equal weight. Items were coded and numerical 'rating scores' assigned prior to analysis (see Table 1).

	Score = 1	**Score = 2**	**Score = 3**
Items 1-5	Well below average	Below average	Average or above
Items 6-7	Would not understand	Would require repetition to understand	Would understand
Item 8	Often misperceives	Sometimes misperceives	Never misperceives

Table 1 Numerical rating scores applied to questionnaire

Due to time constraints it was not possible to trial the questionnaire, however given its similarity to a questionnaire already in use in schools by the local SLT service (West Sussex Primary Care Trust, Speech and Language Therapy Service, Mainstream Schools Team) (Appendix E), this was not felt to be a significant limitation.

Due to ethical considerations it was not possible to administer the questionnaire to children who had *not* been selected for the intervention programme, meaning no control group was possible in this research.

Results

The main aim of the present study is to investigate whether a teacher questionnaire can identify children with problems with verbal comprehension and auditory discrimination. Given this, the data analysis looks at whether those teachers' ratings of their pupil's skills are significantly correlated with the same pupils' scores on formal speech and language assessment. In addition the analysis addresses whether the questionnaire had internal (inter-item) consistency.

A total of 52 questionnaires were distributed and 49 questionnaires were returned; an excellent response rate of 94%. All questionnaires were valid for analysis. Questionnaires were completed fully by respondents, with one exception where the respondent omitted to rate the auditory discrimination item. Only nine respondents (ie nine individual completed questionnaires) contained responses in any of the 'above average' categories for items 1-5 (the first section on 'attentive listening'), so for the purposes of analysis, this was combined with the category 'average' to form a composite 'average or above' category. Two respondents recorded 'don't know' for the item on auditory discrimination. In the few cases where a respondent placed a tick across two boxes (e.g.,between 'often misperceives' and 'sometimes misperceives'), the response was counted as being in the box that the main body of the tick was in.

i) Descriptive statistics

Looking first at the data from the formal speech and language testing (CELF and SIPc), the descriptive statistics (Table 2) show that scores on SIPc quiet were higher than scores on SIPc noise. This concurs with Vance's 2004 data with 4 and 5 year old children (mean age 5 years) which found that performance on the prototype of the SIPc test was significantly better in quiet than against background noise. However, of interest is the fact that the range of scores on SIPc quiet is wider than on SIPc noise (standard deviation 3.5 versus 1.7), with the minimum score on SIPc quiet lower – surprisingly - than the minimum score on SIPc noise.

Test/condition	Number of participants	Minimum	Maximum	Mean	Standard Deviation
SIPc quiet	49	9	29	17.3	3.5
SIPc noise	49	11	22	15.5	1.7
CELF	47	0	15	8.9	4.5

Table 2 Descriptive statistics for the scores of children in the intervention programme for whom completed teacher questionnaires were received

The descriptive statistics for the questionnaire responses (Table 3) show that the two highest rated items were attentive listening in one-to-one situations and basic comprehension (means of 2.68 and 2.62 respectively). The lowest rated items were auditory discrimination and attentive listening in noisy environments (means of 1.58 and 1.72 respectively).

Items with the greatest range of scores were attentive listening in class and comprehension of complex instructions (both with standard deviations of 0.68). Items with the least range of scores were attentive listening in one-to-one situations and comprehension of basic instructions (standard deviations of 0.51, 0.53 respectively).

Item	Mean	Standard deviation
AL Class	1.94	0.68
AL group	2.26	0.60
AL one-to-one	2.68	0.51
AL quiet	2.42	0.61
AL noisy	1.74	0.66
Comprehension (basic)	2.62	0.53
Comprehension (complex)	1.90	0.68
Auditory discrimination	1.58	0.64

Table 3 Descriptive statistics for ratings in questionnaires

Figures 1 to 3 provide visual comparisons of the mean distribution of responses for each item in the questionnaire.

Figure 1

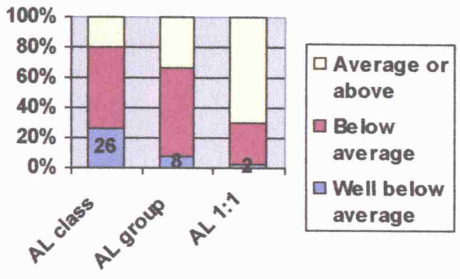


Figure 3

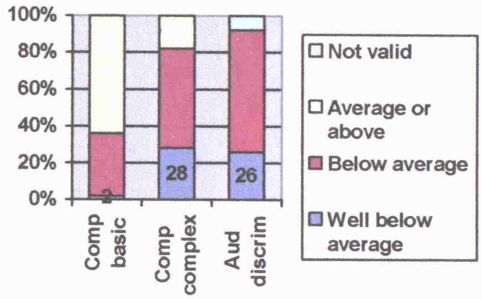
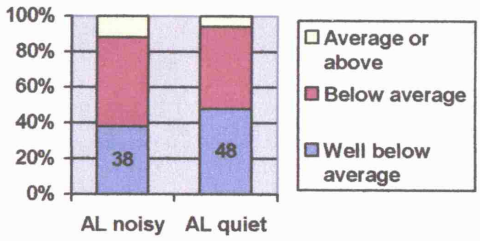


Figure 2



Key:
Figure 1: AL class = Attentive listening in classroom discussions; AL group = Attentive listening in groups AL 1:1 = attentive listening in one-to-one setting.
Figure 2: AL noisy = Attentive listening in noisy environments generally; AL quiet = Attentive listening in quiet environments generally.
Figure 3: Comp basic = comprehension of basic instructions; Comp complex = comprehension of complex instructions; Aud discrim = perception of similar words.

Figure 1 Histogram showing percentage distribution of ratings in questionnaire (items 1-3)
Figure 2 Histogram showing percentage distribution of ratings in questionnaire (items 4, 5)
Figure 3 Histogram showing percentage distribution of ratings in questionnaire (items 6-8)

ii) Questionnaire identification of pupil's comprehension and auditory discrimination problems

The Kolmogorov-Smirnoff test was performed on the questionnaire data. Its significant result indicated that the distribution of the data differed significantly from a Gaussian distribution; hence non-parametric tests were performed subsequently to examine the significance of the data, and relate them to the hypotheses. To test for internal consistency or reliability, Wilcoxon non-parametric tests were used to check for significance within the domains, and Spearman's test of correlation was used to check across the domains. As there was no control group of children, it was not possible to test construct validity.

	AL Class	AL Group	AL 1:1	AL Noisy	AL Quiet	Subtot1	Comp basic	Comp complex	Subtot2	Aud discrim	Total	CELF raw	SIPc quiet
AL Class													
AL Group	.69 **												
AL 1:1	.53 **	.57 **											
AL Noisy	.71 **	.58 **	.41 **										
AL Quiet	.60 **	.76 **	.67 **	.42 **									
Subtot1	.87 **	.87 **	.75 **	.77 **	.84 **								
Comp basic	.29 *	.46 **	.34 *	.31 *	.34 *	.42 **							
Comp complex	.31 *	.41 **	.39 **	.27	.27	.39 **	.63 **						
Subtot2	.33 *	.48 **	.43 **	.31 *	.36 *	.455 **	.85 **	.93 **					
Aud discrim	.20	.29 *	.22	.08	.29 *	.25	.12	.15	.17				
Total	.81 **	.85 **	.74 **	.70 **	.79 **	.94 **	.61 **	.60 **	.68 **	.40 **			
CELF raw	.29 *	.43 **	.19	.17	.29 *	.32 *	.47 **	.46 **	.52 **	.11	.41 **		
SIPc quiet	-.06	-.07	-.10	-.19	-.07	-.12	.02	-.02	-.01	.21	-.05	.13	
SIPc noise	-.36 *	-.19	-.31 *	-.27	-.17	-.32 *	-.22	-.14	-.19	-.08	-.32 *	-.25	.21

Table 4 Correlations between questionnaire and formal tests (Spearman's). n=49 except CELF n=47, auditory discrimination item n=48

Key ** = p<.01, * = p<.05
Subtot1 = sum of items 1-5
Subtot2 = sum of items 6+7
Total = sum of items 1-8

Comparison of verbal comprehension ratings and verbal comprehension scores (CELF)
If the data for the first section of the questionnaire (items 1-5) are taken together, they can be considered an overall reflection of attentive listening. There is a significant – although low - positive correlation between CELF scores and attentive listening ratings (Spearman 0.32, $p<0.05$) – these are shown as 'Subtot1' in Table 4. The data for items 6 and 7 are considered together to represent verbal comprehension ratings overall (shown as 'Subtot2' in Table 4). There is also a significant positive correlation between CELF scores and comprehension ratings (Spearman 0.48, $p=<0.01$). If all the ratings (i.e. items 1-8) are considered together ('Total' in Table 4), there is a further positive correlation with CELF scores (Spearman 0.41, $p<0.01$).

Comparison of ratings (attentive listening) and auditory discrimination skills (SIPc)
There is a significant negative correlation between ratings of attentive listening (Subtot1) and SIPc noise scores (Spearman -0.32, $p<0.05$), as shown in Table 4. This means that, in some pupils, as SIPc noise scores increase, ratings of attentive listening actually decrease. Furthermore there is no significant correlation between attentive listening ratings (Subtot1) and SIPc quiet scores (Spearman -0.12, $p>0.05$),

Comparison of ratings (auditory discrimination) and auditory discrimination skills (SIPc)
There is no significant correlation between nor ratings of auditory discrimination ability and SIPc-noise *or* SIPc-quiet scores (Spearman -0.79, 0.21 respectively, $p>0.05$) (Table 4).

Other results:
Turning to consider the data from the assessments only, it is worth noting that there is no significant correlation between SIPc quiet scores and SIPc noise scores (Spearman 0.21, $p>0.05$) (see Table 4). Furthermore CELF scores do not correlate with either SIPC noise scores or SIPC quiet scores (Spearman -0.25, 0.13 respectively, $p>0.05$).

iii) Questionnaire's Internal consistency

Variable 1	*Variable 2*	*Significance*	*Hypothesis*
Attentive listening: 1:1	Attentive listening: groups	z=-4.58, p=<0.01	H4

	Attentive listening: class	z=-5.39, p=<0.05	H4
Attentive listening: quiet	Attentive listening: noise	z=-4.86, p=<0.01	H5
Basic comprehension	Complex comprehension	z=-5.52, p=<0.01	H6

Table 5 Significance of questionnaire items (Wilcoxon tests)

The Wilcoxon test (see Table 5) shows that teachers give significantly higher (or same)[1] ratings to attentive listening in one-to-one environments than attentive listening in groups or in class discussions ($z= -4.58$, $p<0.01$; $z= -5.39$, $p<0.05$). They give significantly higher (or same) ratings for attentive listening in quiet than attentive listening in noise ($z=-4.86$, $p<0.01$). Teachers give significantly higher ratings for understanding basic instructions than understanding complex instructions ($z= -5.52$, $p<0.01$).

As shown in Table 4, there is a strong significant positive correlation (Spearman 0.71, p=<0.01) between ratings of attentive listening in class and in noisy environments generally. Similarly there is a strong significant positive correlation (Spearman 0.67, p=<0.01) between ratings of attentive listening in one-to-one situations and in quiet environments generally. There is a moderate significant positive correlation between attentive listening ratings and verbal comprehension ratings (Subtot 1 and Subtot2 respectively in Table 4) (Spearman 0.47, p=<0.01), showing that as ratings for attentive listening increase, so do ratings for understanding instructions and perceiving speech.

Finally, Table 4 shows there is no significant correlation between ratings of attentive listening in noise (AL noisy) and ratings of auditory discrimination (Spearman 0.08, $p>0.05$).

[1] Calculated by totalling positive and tied ranks for each item pair.

Discussion

The results of the study will be discussed individually with regard to the hypotheses, and then implications relating to the experiment as a whole will be considered. Finally the results relating to the questionnaire's internal consistency will be discussed.

As predicted, significant positive correlation was found between ratings of attentive listening overall (i.e., questionnaire items 1-5 combined) and children's comprehension test scores on CELF; and between verbal comprehension ratings and CELF scores. This means that as scores on CELF increase, ratings of listening and comprehension increase. Therefore hypothesis 1 can be accepted. These findings are in line with the literature that claims a link between listening and understanding (e.g., Jerger and Musiek, 2000; Tallal 2000) and indicate also that teachers are accurate predictors of children's abilities in these areas. Hence the first two sections of the questionnaire could be a useful screening tool in clinical practice for identifying children's comprehension difficulties.

Turning to the other two main hypotheses, involving SIPc scores, surprising patterns emerge. As children's scores on SIPc noise increase, teachers' ratings of attentive listening overall decrease (and vice versa); a significant negative correlation. There is also no significant correlation between attentive listening-in-noise ratings and SIPc scores in noise or in quiet. Therefore hypothesis 2 must be rejected. In addition, there is no significant correlation between SIPc noise scores and auditory discrimination ratings. This means hypothesis 3, the main hypothesis of this study, must be rejected.

For SIPc noise, there are two further items ('AL class' and 'AL one-one') with significant *negative* correlations. There are no significant correlations (positive or negative) between SIPc quiet and *any* of the questionnaire ratings.

Given this study's focus on auditory discrimination, the findings are disappointing. The literature on links between comprehension, attentive listening and auditory discrimination ability (e.g., Riccio & Hind, 1996; Jerger & Musiek, 2000; Serniclaes et al, 2001; Tallal, 2000; Reed, 1989) might have led to higher expectations of significant positive correlations.

Although not included as a hypothesis, there is no significant correlation between SIPc scores and CELF scores (or between auditory discrimination ratings and CELF scores); if auditory discrimination were a causal factor of children's poor verbal comprehension, one might expect to see a significant positive correlation.

The data analysis has resulted in rejection of two of the key hypotheses of the present study. It is important to explore possible explanations which might account for these findings. The significant positive correlation between CELF scores and comprehension ratings and lack of significant positive correlation between SIPc noise scores and auditory discrimination (or any other) ratings invites one of two conclusions:

- that teachers are *not* reliable predictors of children's auditory discrimination skills, or
- or that they *are* reliable predictors, but that other factors influenced the results.

Such confounding factors could include any or all of: bias in teacher judgement; the questionnaire's content validity; clarity of questionnaire wording, shortcomings of the SIPc test and disparity between 'real-world' observations and test conditions.

Further research in this area should control for, and as far as possible, exclude these factors, if conclusions are to be drawn.

Theory 1: Teachers are not reliable

It is possible that the teachers, knowing the aim of the Listening to Speech programme, could have unwittingly biased their answers to the auditory discrimination item. Indeed, no teacher rated any child as 'never misperceives' on this item, although three were unsure and chose 'don't know'. (This therefore includes the children who passed SIPc.) This has the effect of reducing the range of scores and statistically this might have a 'skewing' effect, making analysis less reliable.

Equally auditory discrimination may not be a skill that some (or any) teachers had considered in detail before and they found it more difficulty to decide a rating for their pupils. As a result some teachers (for example those with more experience) may have been more accurate raters of their pupils' ability than others. As the questionnaires were completed anonymously, it was not possible to match respondents to questionnaires. Hence it was not possible to explore inter-rater reliability to explore this theory.

Theory 2: Teachers are reliable

Kenny and Chekaluk (1993) caution that accuracy of teachers' judgements of their pupil's (reading) ability may be influenced by a number of factors external to the individual teacher, such as the '*rapidly changing cognitive and behavioural characteristics of children in kindergarten, the age/year at which tests/teacher ratings are obtained, and the construct validity of the screening instrument and criterion tests employed*' Some or all of these cautions could be levelled at the present study, particularly as the child participants in the present study are at an age when they may still have immature skills in all three areas (attention, comprehension and auditory discrimination).

The remainder of this section assumes that teachers *are* reliable predictors of children's abilities, and explores influencing factors that might have led to the study's findings.

Content validity of questionnaire

To have 'content validity', a teacher rating instrument needs to measure the same behaviours that a corresponding standardised test measures (e.g., Flynn and Rahbar, 1998). It is possible that there was a discrepancy between the ability the questionnaire item on auditory discrimination sought to investigate and the ability SIPc investigates.

Reasons for this could include the as-yet poorly-defined nature of auditory discrimination problems (i.e., isolating it from other problems such as hearing loss, attention or comprehension problems) and questions around causality. These may account for the difficulty other researchers have encountered in measuring auditory discrimination qualitatively through instruments such as questionnaires. For example, following use of a parent questionnaire aimed at identifying children with CAPD, Meister, von-Wedel and Walger (2004) concluded '*the validity of such a questionnaire is questionable at present, since APD is not very well specified, and standardized diagnostic tests are lacking'.*

Clarity of auditory discrimination item wording

If Meister et al's (2004) claim for poor specification of APD is accepted and extended to auditory discrimination, then a further weakness of the questionnaire may have arisen from the clarity of wording of the auditory discrimination item. In other words, in the authors' eyes, the questionnaire might have been measuring the same behaviour as the assessment, but the teachers' understanding of 'Perceiving words accurately...' could have been subtly different. A trial on a small group of teachers, followed by a brief, structured interview to discuss their responses, might have identified and factored out this variable.

Hence the lack of reliability of the auditory discrimination item might be attributable to unclear wording, or it may be that what teachers consider to be auditory discrimination is different to what was intended by the questionnaire authors. It is possible that 'auditory discrimination', when expressed as 'Perceiving words accurately' may mean different things to different groups of professionals, or even to different people. Further investigation of this theory is needed.

Shortcomings of SIPc test

The results of this study showed no significant positive correlation between CELF scores and SIPC scores, or between SIPc quiet and SIPc noise conditions. CELF is a standardised, well-established and widely-used assessment, whereas SIPc is still in development. In the data from the Listening to Speech study, (i.e., test scores from the full cohort of children, not just those selected for the intervention programme), there are concerns about the 'noise' condition, with many children performing at chance level (Vance personal communication, 2005). It may be that SIPc's experimental status means it is not accurately reflecting children's abilities: children with well-developed auditory discrimination skills may have struggled with the demands of the assessment task.

Discrepancy between test and real-world conditions.

The fact that no teacher rated any child as 'never misperceives' on the auditory discrimination item, could be a reflection of the variable auditory discrimination skills of under-fives. The variable performance of under-fives in tests of auditory discrimination (Concanon, 1996; Vance, 1996) has already been discussed. Furthermore, *no* child

scored 100% on SIPc in both noise and quiet conditions. Therefore it could be argued it is unsurprising that they were given sub-optimal ratings of that ability by their teachers, particularly in view of the 'real-life' situations upon which the teachers were basing their ratings. Allen and Wightman (1994), in considering children's performance on auditory temporal processing tasks, comment that performance on specific tasks can vary from one testing situation to another, which contributes to the difficulty in drawing precise boundaries between typical and atypical patterns of development.

It is inadvisable to assume that it is only the children with below-average language skills who behave less attentively in class. Although the design of the study did not allow for the gathering of in-depth opinions from the teachers, space for comments *was* provided on the questionnaire (Oppenheim, 1992), with the prompt 'Are there any situations not mentioned above, in which the child appears to show difficulty with attentive listening or understanding?' Twelve of the 49 completed questionnaires contained comments. These responses thus form an unrepresentative sample and have not been analysed qualitatively, but the comments may add to the debate around the results of the study (Appendix F). A number of comments allude to children being easily distractible, and other related behavioural difficulties. An exploration of such issues is not within the scope of this study (see instead Botting & Conti-Ramsden, 2000), however it is clear that real-life situations involve complex interactions of abilities and behaviours.

It may be that some children who are rated as behaving less attentively in noisy classrooms and appear to understand less well, may respond better in a test situation with a noise condition - particularly in an unfamiliar environment with an unfamiliar adult, with no distractions, faced with a novel test. Conversely, perhaps children with problems *should* be expected to attend and therefore perform better (given that teachers rated all children as better in one-to-one situations than other situations) in a test situation. It does remain however, that other researchers *have* found better correlations between attention and auditory discrimination (e.g., Geffner et al, 1996).

More fundamentally, it could be that comprehension, attentive listening and auditory discrimination ability are independent functions. However this would contradict the bulk of the evidence already cited and is therefore discounted as a valid theory.

Criticisms of study design

No control group

The committee granting ethical approval for the study was concerned about the gathering of information about the children from their teachers. It was therefore only possible to do so for the group of children selected for intervention. Consequently there is no data from a control group of children (i.e., those for whom there is no concern about language and/or auditory discrimination skills). This meant that teachers were, in theory, aware that they were completing questionnaires on children who had failed one or more assessments and were eligible for the intervention programme. Care was taken not to emphasise this aspect to the teachers, however its potential effect cannot be completely discounted and knowledge of this may have introduced bias into the teachers' responses.

Experimental population not normal

Although all children in a class were eligible for the study, the children required parental consent to participate. This form of recruitment bias may have resulted in an abnormal experimental population, for example socio-demographic skewing (ethnic, literacy etc).

In addition, given that many of the children selected for LtS intervention and hence who were child participants in the present study were chosen because of their poor SIPc scores (i.e. performance at chance level), the available data is less likely to result in a normal distribution.

Questionnaire consistency

As predicted, on the 'within-domain' analyses, teachers rated the children as better listeners in one-to-one than in groups or class discussions, shown by their higher ratings of the former (hypothesis 4). They rated the children as better listeners in quiet environments than noisy ones (hypothesis 5). They rated the children as better able to understand basic instructions than complex ones (hypothesis 6). All these findings reached significance, therefore hypotheses 4, 5 and 6 can be accepted.

Again as predicted, on the 'between-domain' analyses, there was a significant positive correlation between attentive listening in class and in noisy environments (hypothesis 7) and between one-to-one and in quiet environments (hypothesis 8). In addition, there

was a significant positive correlation between attentive listening ratings. Therefore hypotheses 7, 8 and 10 can be accepted.

However there was no significant correlation between ratings of attentive listening in noise and ratings of auditory discrimination, meaning hypothesis 9 must be rejected.

In summary, the first two sections of the questionnaire (attentive listening and verbal comprehension) can therefore be said to have significant inter-item or internal consistency, but the final item, on auditory discrimination, does not have significant inter-item consistency. Possible reasons for this have already been discussed; these need to be resolved before the item could be a useful instrument for screening for auditory discrimination problems in clinical practice.

It should be noted that, although calculating internal consistency gives a useful indication of the reliability of the questionnaire, it does not account for a number of the potential sources of error in testing – for example, the respondent's state of mind or the conditions encountered while completing the questionnaire.

Recommendations

If the research is to be repeated, a number of modifications should be addressed:

- CELF-P's is a reliable and well-established assessment of verbal comprehension. Given the significant positive correlations between the CELF-P test scores and questionnaire ratings of children's comprehension, it can be claimed the teachers *were* reliable judges of their pupils' abilities in this domain. It might therefore follow that the teachers were reliable judges of their pupils' auditory discrimination abilities; however until SIPc is fully standardised, this can only remain a hypothesis. Repetition of the study once SIPc is standardised would be of value.
- In the meantime, the same cohort of children could be tested on Auditory Discrimination and Attention Test (ADAT) for comparison (as ADAT is standardised it would identify whether the problem lies with SIPc or the questionnaire).
- As the attentive listening and comprehension sections of the questionnaire already correlate with CELF scores, there is no need to repeat this part of the study.
- The focus on auditory discrimination in the teacher questionnaire may also need modification, given that all the other items showed inter-item consistency. Brief

telephone interviews could be conducted with teachers to establish their views about the clarity of the auditory discrimination item in the questionnaire and their views on auditory discrimination skills in four-year olds. In addition, some researchers (e.g., Dockrell, 2003) claim one item in a questionnaire is not sufficient to identify a problem; additional items exploring auditory discrimination could be of value. However it should be remembered that the teacher questionnaire is designed to function as a screening tool and could never replace the need for in-depth assessment on a case-by-case basis, once a child's difficulty with auditory discrimination or verbal comprehension had been identified.

Conclusion

This study has offered much conjecture as to the role of teachers in identifying children's language difficulties, and has not been able to reach firm conclusions. Use of a new teacher questionnaire was inconclusive, with sections on attentive listening and comprehension appearing to be of significant benefit, whilst its focus on auditory discrimination appears to need modification if it is to be of real use in clinical situations. Further research could modify the questionnaire, following interviews with teachers. It would also be valuable to repeat this study with another test of auditory discrimination in order to confirm the reliability of SIPc. These measures would exclude confounding factors and would confirm whether screening for auditory discrimination problems using a teacher questionnaire is worth considering clinically for this population.

There may be an unexpected benefit in the use of such an instrument. Some teachers commented that completing the questionnaire focused their thoughts on the child's abilities in those areas (Vance, personal communication, 2005). Therefore if the questionnaire can be modified to function reliably, it may have serve to emphasise to teachers the links between verbal comprehension, attentive listening and auditory discrimination.

While doubt remains about the questionnaire's validity however, SLTs may wish to look to other sources for information about children's auditory discrimination difficulties. For now, the most reliable alternative to screening may be the information teachers provide as part of their completion of the Foundation Stage Profile handbook.

[Word count: 9,253]

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Head of Department
Jane Maxim
MA, PhD, DipCST,
Reg. MRCSLT

APPENDIX A

10th September 2004

Version 2

PARENT INFORMATION SHEET

THE 'LISTENING TO SPEECH' PROJECT – PHASE ONE

Dear Parent,

I am a Speech and Language Therapist based at University College, London, and we are carrying out a research project in your child's school. You are invited to allow your child to take part in this project. Before you decide, it is important for you to understand why the research is being done and what it will involve. Please read the following information carefully and discuss it with others if you wish. You are welcome to ask me if anything is unclear.

What is the purpose of the project?
To identify children who may benefit from taking part in a new programme in school to develop 'listening to speech' skills.
We know that some young children find it difficult to hear the small difference between sounds and words that are very similar, for example, 'pin' and 'bin', especially when there is other noise in the background. This may affect their ability to listen in class for example. We are looking to see if we can develop these 'listening to speech' skills in some of the children in the first year or so that they are at school.

Why has my child been chosen?
Your child has been chosen because he / she is aged 4 or 5 years, and is in one of the reception classes of one of the schools involved in the research.

Does my child have to take part?
It is up to you to decide whether or not to allow your child to take part. If you do decide to allow your child to take part should keep this information letter and sign the attached consent form. If you decide to allow your child to take part you are free to withdraw him/her at any time, and without giving a reason. A decision to withdraw your child at any time, or a decision not to take part, will not affect the standard of care that your child receives. When we go into school to carry out the study, we will also ask your child if he/she would like to take part in the activities. If he/she does not want to, then he/she can stay back in class with the teacher.

What will happen if my child takes part in the project?
We will visit your child's school, and he/she will be taken out of class to a quiet area in school. He/she will be given several tasks. These will include a computer game in which he/she listens to words and selects a picture on screen, and listening to sentences and pointing to pictures, listening to some made-up words and repeating them, looking at pictures and answering questions about them. We may see your child two or three times, and each session will not take more than 20 minutes. Some children will be seen by final year speech and language therapy students, and some by myself. We have all had experience of working with young children and have been screened by the Criminal Records Bureau.

We will make tape-recordings of the children doing some of the tasks, so that we can check that we have written down their answers correctly, and these recordings will then be wiped.

What are the possible benefits of taking part?
If selected your child will have the opportunity to enter the second phase of the project and benefit from taking part in the 'listening to speech' programme and this is aimed at improving listening and attention. We hope this will aid your child's language development and his/her ability to listen in class.

Will information about my child be kept confidential?
All information which is collected about your child during the course of the project will be kept strictly confidential. The information will not have your child's names or any other identifying information.. Each child will be assigned an identification code and the information collected will be stored under this number. All information will be collected and stored in accordance with the Data Protection Act

What will happen to the results of the research study?
We will send you a brief outline of the findings to your child's school. The final-year students will each write up a report on the project and copies of these will be kept in our library. The overall findings will eventually be published for speech and language therapists and teachers to help them in their work.

Who is organising and funding this research?
The research is organised by University College London and is funded by The Health Foundation.

Who has reviewed this study?
This project has been approved by West Sussex Local Research Ethics Committee.

Contact for further information
If you have any questions about this research, or about the rights of participating children, please do not hesitate to contact me now or in the future. You can leave a telephone message for me on 020 7679 4255 and I will phone you back, you can ask your child's teacher to tell me that you would like to see me, or you can send an email to m.vance@ucl.ac.uk
I will also be available to speak to you in school at 'going home' time on .....

Thank you for reading this information sheet, and for considering allowing your child to participate. If you are happy to allow your child to participate, please sign one copy of the attached consent form and return it to your child's teacher by ..... Please keep this information letter and the spare consent form.

Maggie Vance, PhD, MSc , MRCSLT
Registered Speech and Language Therapist
Research Fellow

APPENDIX B

Participant Identification Number:

CONSENT FORM

Title of Project: 'Listening to Speech' Phase One

Name of Researcher: Dr Maggie Vance

Please initial box

1.	I confirm that I have read and understand the information sheet dated 10/9/04 (version 2) for the above study and have had the opportunity to ask questions.	
2.	I understand that my child's participation is voluntary and that I am free to withdraw him /her at any time, without giving any reason, without his/her care or legal rights being affected.	
3.	I agree for my child to take part in the above study.	

_____
Name of Child

Name of Parent / Guardian	Date	Signature
Researcher	Date	Signature

1 for parent; 1 for researcher; 1 for school records

SIPc target stimuli

Target	Option 1	Option 2
XAB practice block		
sibe	sibe	Gibe
fol	gol	Fol
pish	vish	Pish
dap	dap	Daf
tarp	tarp	Darp
vup	vut	Vup
sibe	gibe	Sibe
fol	fol	Gol
pish	pish	Vish
dap	daf	Dap
tarp	darp	Tarp
vup	vup	Vut
dap	daf	Dap
tarp	tarp	darp
vup	vup	Vut
XAB block 1		
Stish	spish	stish
sleen	sleen	sween
Mipe	nipe	mipe
Parb	parb	pard
Geef	deef	geef
Peeg	peeg	teeg
Sarp	farp	sarp
kidge	gidge	kidge
Veep	feep	veep
Son	son	Ton
meeg	beeg	meeg
Serl	serl	Verl
Sim	bim	Sim
trib	trib	Trif
bood	zood	bood
XAB block 2		
skeef	skeef	steef
Snig	snig	smig
Gite	gike	Gite
hees	hees	heesh
Plid	plig	Plid
Bef	bef	Bes
Kut	tut	Kut
Dem	dem	Bem
Sork	zork	sork
chorm	chorm	jorm
deeb	neeb	deeb
Lars	lars	Lart
Farn	garn	farn
Tis	tis	Tid
mert	merz	mert

Listening to Speech Project
Teacher questionnaire

Child's name: .....

Today's date: .....

Attentive listening skills
Attentive listening is a child's ability to focus on what's being said to him/her. Please rate your impression of the child's skills in the following situations, **compared to his/her peers** (tick one box per row):

	Well below average (Never listens attentively)	**Below average** (Tends not to listen attentively)	**Average** (Mostly listens attentively, occasional lapses)	**Above average** (Always listens attentively)	**Don't know**
During class discussions					
In small groups					
One-to-one					
In quiet environments generally					
In noisy environments generally					

Understanding of spoken language
Again, **compared to his/her peers**, please rate your impression of the child's skills in the following situations (tick one box per row):

	Would not understand	**Would require repetition to understand**	**Would understand**	**Don't know**
Understanding basic questions, simple instructions (eg "Where is the ball?", "Give the book to James")				
Understanding complex instructions ("If you've finished your work, put away your book and line up by the door")				
	Often misperceives	**Sometimes misperceives**	**Never misperceives**	**Don't know**
Perceiving words accurately (e.g. 'hearing' the difference between 'ship' and similar- sounding word 'chip'.)				

And finally.... Are there any situations not mentioned above, in which the child shows difficulty with attentive listening or understanding?.....

.....

.....

.....

Thank you for completing this questionnaire. Please return it to.....

APPENDIX E

Speech and Language Therapy
Inclusion Project
Teacher Questionnaire 1
(pre-support)

Name of child: DoB:
School: Year Group:
Classteacher: Date:

Please complete the following questionnaire on the above named child. This will provide us with information on how the child functions within the classroom in language related tasks. It will help us plan support to suit his/ her needs and evaluate whether the support is working.

1. **Attention and Listening Skills**

Please rate the child's skills in the following activities **compared to his/her peers** (tick one column per line):

	Very Poor (0)	Poor (1)	Average (2)	Good (3)	Excellent (4)
Listening during assembly					
Listening during whole class discussions					
Listening in small group					
Listening on one to one					
Ability to ignore distractions in class					
Ability to start task without support					
Ability to stay on task without support					
Ability to make transition between activities without support					

2. Understanding of Spoken Language

Please rate the child's skills in the following activities **compared to his/her peers** (tick one column per line):

	Very Poor (0)	Poor (1)	Average (2)	Good (3)	Excellent (4)
Understanding of basic questions					
Understanding of simple instructions					
Understanding of complex instructions					
Understanding of abstract information (eg. concept of time)					
Understanding of topic vocabulary					
Understanding of subtle meanings (jokes, double meanings, idioms, sarcasm etc) **(KS2 only)**					
Ability to recognise when s/he has not understood **(KS2 only)**					
Ability to ask for help when s/he does not understand **(KS2 only)**					

APPENDIX F

Teachers' comments - questionnaire

"(Obviously) little understanding of phonemes and relating them to actual objects"

"Always repeats the question you have asked before answering"

"Is very difficult to judge as his behaviour is so unpredictable that is it hard to get him to co-operate to venture into any of the above situations" [Nb this teacher had replied 'don't know' for the word perception item]

"During lining up and PE sessions (particularly outside), finds it difficult to listen attentively to instructions." (This comment was made for two separate children)

"Has a short attention span and is easily distracted, therefore she often has missed instructions or explanations"

"Has a particularly short attention span and is very easily distracted. It is very rare that she sits facing the speaker so therefore usually doesn't hear instructions or explanations at the first time of speaking."

"Appears to find it difficult to 'hold' information. She gives the impression of being stubborn, but this could be because she doesn't understand what is being asked of her."

"...In a large group, eg. 'on the carpet'. Distracts other constantly, easily distracted."

"Very easily distracted, always wanting to play, worrying what others are doing."

"Tries very hard to listen, but has difficulty with basic concepts, eg is very literal. Easily distracted. Forms obsessive relationships which hinder concentration."

"Has recently had her hearing checked and there was a deficiency identified."