

THE RELATIONSHIP OF AUDITORY AND VISUAL PERCEPTION WITH READING RELATED SKILLS

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Abstract

Perceptual skills are regarded as important factors in the development of early reading skills. The current study seeks to identify the relationship of visual auditory perceptual variables with reading and its related skills in children of grade I to VIII. A total of 160 typically developing children (TDC) from standard I to VIII were taken, covering 20 children (10 males and 10 females) from each grade. Participants were divided into two groups according to the medium of instruction in the respective schools: TDC were being educated in a Hindi medium school (TDCH) and TDC who were being educated in an English medium school (TDCE). A Hindi adaptation of Early Reading Skills (ERS,) originally developed by Rae & Potter (1973), was administered in single 30 minute sessions. The descriptive analyses revealed homogeneity in the pattern of acquisition of perceptual skills. But the English medium children were found to have better scores on all the sections of perceptual skills. In all the grades, in both the groups, a statistically significant relation existed between all the perceptual parameters and reading related skills. None of the correlations were found to be statistically significant, except that between auditory perceptual composite score and structural analysis test score. The results of this study suggest that a perceptual deficit may hinder reading development in the elementary grades, but in higher grades a more complex interrelation of perceptual and reading related skills exist. Keeping in mind the results of this study may help avoid inaccurate assessment results or clinical reasoning, due to undetected or unsuspected perceptual deficits.

Key words: Skills, development, acquisition.

The passive process termed as sensation brings information from the outside world into the body and to the brain. The active process of selection, organization, and interpretation of the information brought to the brain by the senses, can be defined as perception. The components of perception include discrimination (judgments to define subtle differences), processing (ability to sequence meaningful language), memory (immediate recall), and/or comprehension (interpretation) (Gardner, 1985).

Visual perception is the process of recognition and interpretation of information taken in through the sense of sight and auditory perception is the process of recognition and interpretation of information taken in through the sense of sound. The mental organization and interpretation of the sensory information obtained through the visual modality is visual perception. The intent of visual perception is to attain awareness and understand the local environment, e.g., objects and events. Visual perceptual skills are important for learning how to form letters, copying, sizing, spacing, and orienting letters and words correctly. The development of visual perception occurs as a systematic increase in the ability to perceptually analyze and discriminate objects. The ability to

identify, organize and interpret sensory information received through hearing is called auditory perception. Auditory perceptual skills impact the ability of children to benefit from instruction, follow directions, and participate in class discussions.

Visual auditory perceptual skills are regarded as important factors in the development of early reading skills (Smith & Dechant, 1961). Studies have reported significant correlations between perceptual skills and reading in the early primary grades (Bruininks, 1968). Studies on children of middle socio-economic status revealed moderate to high correlations between perceptual abilities and reading performance (Sterritt & Rudnick, 1966). Gardner (1985) and Badian (2005) found a relationship between perception and literacy readiness skills.

Visual memory was found to be integral to the reading process as established by Samuels and Anderson (1973). According to Whisler (1974), visual discrimination is an essential skill for reading readiness. Rosner (1975) suggests that visual perceptual skills are closely related to reading comprehension. Kavale (1982) performed a meta-analysis whose results indicated that visual perceptual skills are predictive of reading

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performance in school, especially during the preschool and primary school grades. A correlational study also lends support to this speculation (Slaughter, 1983). The visual sense has a pivotal role in the total process of intellectual development (Getman, 1984). Visual processing is significantly related to reading (Olson & Datta, 2002). These two researches also successfully established the relationship between visual discrimination and literacy readiness. Pammer and Kevan (2007) assessed visual discrimination skills and the results indicated that when controlling for Intelligence Quotient (IQ), visual discrimination accounted for the 6% variance reported in reading ability of the participants.

A strong relationship has been shown between auditory perceptual skills and primary grade reading achievement (Rosner, 1972). Correlational studies conducted by Burrows and Neyland (1978), concluded that auditory perception in kindergarten is indicative of reading success in later grades. Marston and Larkin (1979) found that the relationship between verbal and nonverbal auditory discrimination tasks and literacy success was significant. Kavale (1981) showed that a relation exists in preschoolers to grade VI. Watson and Miller (1993) found that a deficit in auditory perception holds lifelong consequences for literacy success.

Studies suggest that correlations between perceptual ability and reading appear to decrease with age. Bruininks (1969) found that the relation between perceptual abilities and reading performance in disadvantaged boys was low to moderate in magnitude. It was thus concluded that perceptual ability appeared to be more related to early reading skills than to their subsequent elaboration. Fazio (1997) also found no relationship between visual perception and literacy readiness. Research conducted later provided additional confirmation that poor and normal readers have comparable visual perceptual abilities (Fletcher, Shaywitz, Shankweiler, Katz, Liberman, Stuebing, & Shaywitz, 1999). Recent research has found a reciprocal relationship between auditory perceptual skills and literacy readiness (Cestnick & Jerger, 2000; Cestnick, 2001; Bretherton & Holmes, 2003).

The establishment of the relationships between visual and auditory perception and reading related skills may provide information to assist in the identification of linguistic deficits at the school level. Identifying deficits at the earliest

age may advance the effectiveness of intervention. With the advancement of intervention, it is possible that literacy delays may be identified and remediated before children reach an age in which the delay becomes stigmatizing and debilitating to future scholastic success.

Need for the Study

The view that deficits in perceptual abilities may have a negative effect on reading related skills is still debatable. Especially in the Indian scenario, wherein the schooling system are organized differently in terms of government and/or private enterprises and as well as because there are different languages used as medium of instruction in different schools, there is an urgent need to investigate the relationship between perceptual abilities and skills related to reading. Previous studies have not included tests of perceptual abilities and their correlation with reading related skills in the same sample. Few studies have examined the relationship of perceptual abilities with reading performance in disadvantaged (lower SES) children. Children from a lower SES display marked perceptual deficiencies (Covington, 1962; Deutsch, 1964; Clark & Richards, 1966; McConnell & Robertson, 1967). Therefore, a study which attempts to address the above mentioned areas and tries to find out certain observations and facts related to these problems is much needed.

Aims of the Study

The present study seeks to identify the relationship of visual auditory perceptual abilities with reading and related skills in children of grades I to VIII. An understanding of this relationship in view of the Indian educational system may enhance the effectiveness of assessment and treatment of children with delayed literacy skills.

Method

Reading related skills' include five basic cognitive processes involved in reading: phonological processing, syntactic awareness, working memory, semantic processing, and orthographic processing (Siegel, 1993). It is not clear whether the above mentioned measures are appropriate for children from linguistically diverse backgrounds. This study uses a correlational research design to analyze the relationship among a large number of reading related variables, especially perceptual variables and predict the degree and direction of the relationships.

The test, a Hindi adaptation of Early Reading Skills originally developed by Rae & Potter (1973), included the following sections further divided into subtests: 1) Testing of perceptual skills included auditory identification, auditory recall, auditory discrimination and visual discrimination test (assessed in two separate levels). 2) Phoneme Grapheme Correspondence Test was assessed in two separate levels which required the child to identify the beginning consonant, ending consonant and vowel sounds in the spoken stimuli and the identification of consonants constituting a blend. 3) Structural Analysis section required the child to identify correct form of verb (in two levels) and to underline the root word in words with prefixes and/or suffixes (in the third level). 4) Blending was also assessed in two separate levels. 5) Oral Reading included four short passages arranged in the order of decreasing level of cohesion. The passages contained the following number of words: Passage 1 (44 words), Passage 2 (227 words), Passage 3 (357 words) and Passage 4 (522 words). Four questions were created for each passage and the order of the questions remained the same: (1) setting inference, (2) causal-near inference, (3) causal-far inference and (4) elaborative inference. A common scoring system was used and a score of 1 was given for each correct answer. The maximum score for each subset varied according to the number of items in it.

Participants

Children between the ages of 6-13 years studying in grades between I to VIII in a school following the academic curricula proposed by Central Board of Secondary Education (CBSE) were recruited. A total of 160 typically developing children (TDC) from I to VIII grade were taken, 20 children (10 males and 10 females) each from different grades. All participants were typically developing children (TDC), without any speech and language deficits and delayed milestones and with no present/past history of any neurological, psychological problems and/or sensory deficits. Other inclusion criteria required that these children should have been studying in the same school since the beginning of their education and all of them should have had at least average reading achievement in Hindi as well as in English, based on their school records. It was required that participants should not have repeated a grade at any point in their school career, and should have completed all their schooling, thus far in an ordinary school. In addition, their last school report had to indicate at least 60% marks (fourth grade/B2/Good with a grade point of 7) for the language and literacy

areas. These criteria were included to avoid the possibility of including children with subtle, previously undetected language disorders. At the time of the present study the children had already spent about six months in a particular grade.

Education in India is provided by the public sector as well as the private sector. Participants were recruited from local Government and Private schools, tuition centres and through personal contacts. Children were divided into two groups according to the medium of instruction in the respective schools: typically developing children who were being educated in a Hindi medium school (TDCH) or typically developing children who were being educated in an English medium school (TDCE). Each group had 80 TDC belonging to grade I to VIII. TDCH children came from Hindi speaking homes with Hindi being their medium of instruction at school also, since the start of their schooling. TDCH were recruited from Government schools under the administration of the Delhi Government. TDCE children came from predominantly Hindi speaking homes with English being their medium of instruction at school since the start of their schooling. TDCE were recruited from Private schools. TDCE were exposed to both Hindi and English since the start of their schooling and were currently spoken on a daily basis. Children who spoke languages other than Hindi and English were not included.

All the schools catered to mixed SES families, but as previous research does predict a predominantly higher SES opting for private education, the two groups of TDCH and TDCE can be to a certain extent assumed to represent a lower and a higher SES respectively. In order to ensure that participants were as homogeneous as possible in terms of socio-demographic variables, schools within the same geographic area in Delhi were selected. In order to control for socioeconomic status to some extent, equal numbers of participants from each group attended government and private schools.

The test was administered on 160 typically developing children (TDC). The children were tested individually in a single 30 minute session in a quiet, noise free environment. The items were presented in a fixed order and an audio video recording of the sessions was carried out.

Results

The descriptive analysis of the data has been dealt with both test section wise as well as grouped according to the medium of instruction.

The Auditory perceptual section of the test had three subsections assessing the auditory identification level (AIL), auditory recall level (ARL) and auditory discrimination (AD). The comparative performance graphs below clearly depict that English medium children fare better than their Hindi medium counterparts, though the difference in their performance falls as they progress to higher grades. A majority of Hindi medium children achieve full scores on the auditory perceptual subsections by grade III or grade IV, while English medium children achieve this by grade II and in some cases (as in auditory discrimination) in grade I itself.

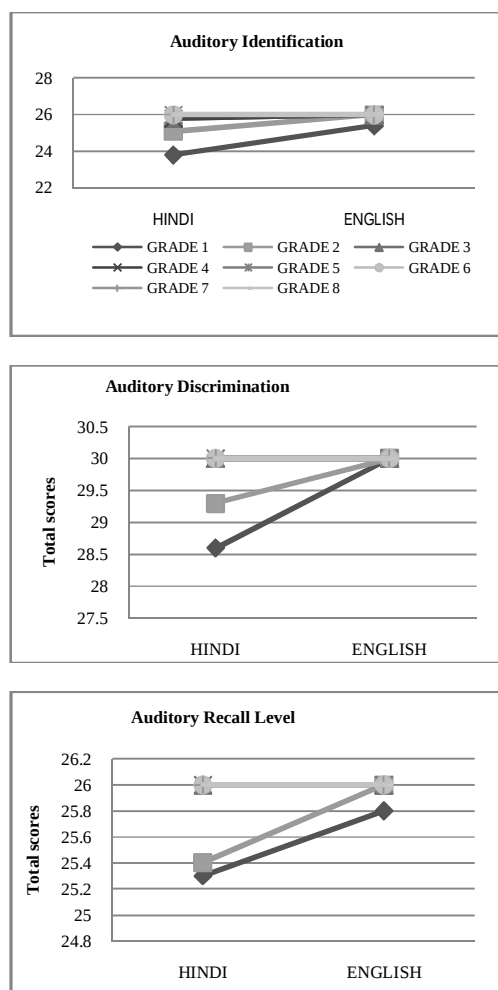


Figure 1: Auditory Perceptual scores in TDCH & TDCE

Visual discrimination assessed in two separate levels (level 1 assessing the ability to discriminate differences in forms, size, shape, and orientation; level 2 assessing the ability to discriminate between Hindi alphabets), also showed a similar pattern of better scores by English medium children and achievement of full scores by the primary grade children itself.

Overall, till grade IV, all the children scored full on the sections assessing visual discrimination (VD1 & VD2).

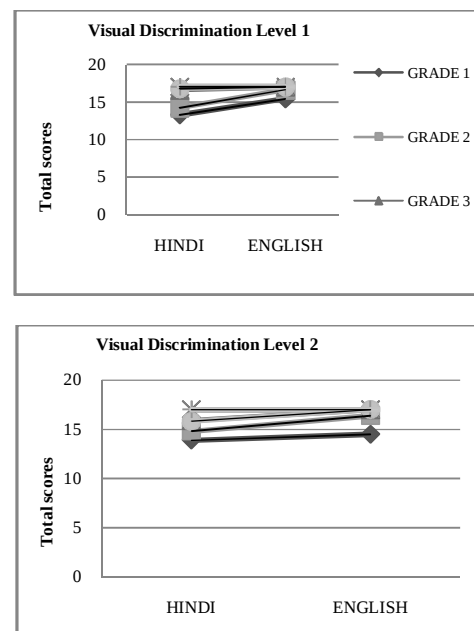
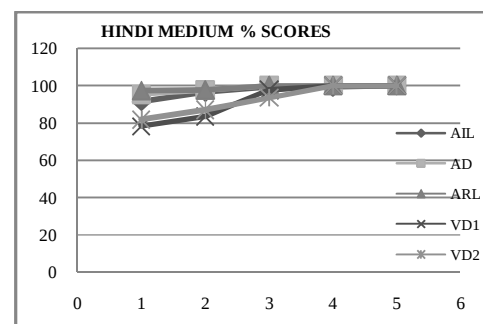


Figure 2: Visual Perceptual scores in TDCH & TDCE

The percentage scores were analyzed separately for the Hindi and English medium children, for the first five grades. The Figure 3 clearly depicts that performance is better on the auditory perceptual section as compared to visual perceptual section in all the grades for both the mediums. Among the auditory perceptual section also, the scores increase in the following order: auditory identification < auditory discrimination < auditory recall, till all of them reach the maximum score. In case of English medium children, the auditory recall section had slightly higher scores than auditory discrimination. While visual discrimination level 2 (VD2) was found to have consistently scored better than visual discrimination level 1 (VD1) in the first two grades, the opposite was observed in grade III as well as in English medium children too.



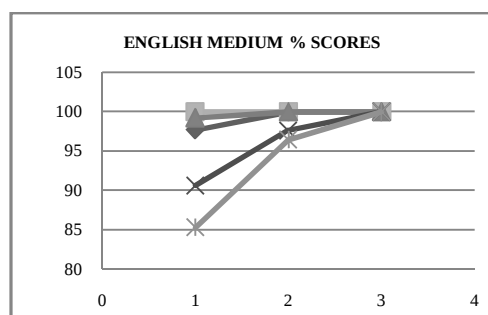


Figure 3: Perceptual scores in TDCH and TDCE

The current data set had medium of instruction, grade & gender as independent variables and all the parameters of the test as dependent variables. A multivariate analysis was thus used to analyze it. A p value $< .005$ indicates that the interaction is statistically significant. MANOVA results indicated that medium of instruction [Wilks' Lambda = .872, $F(3, 126) = 6.138$, $p < .001$] and grade significantly affected [Wilks' Lambda = .567, $F(21, 362.354) = 3.768$, $p < .001$] the combined dependent variables of the test parameters. There was a statistically significant difference, so further follow up tests were done.

The tests of between-subjects effects revealed that both medium of instruction and grade significantly affected the perceptual parameters of Auditory Identification Level (AIL) and Auditory Discrimination (AD), but Auditory Recall Level (ARL) was affected only by the grade the participant belonged to. Univariate analyses for medium of instruction revealed that AIL and AD was affected in case of both Hindi and English medium of instruction, while ARL was affected in neither group of children. Univariate analyses for the effect of grade revealed that all the auditory perceptual variables of AIL, ARL and AD were significantly affected only in grade I. A further medium v/s grade interaction revealed that this was true in case of Hindi medium of instruction only.

The tests of between-subjects effects revealed that both medium of instruction and grade significantly affected the perceptual parameters of visual discrimination levels one and two (VD1 & VD2). Univariate analyses for medium of instruction revealed that both the visual perceptual tests were affected in case of both Hindi and English medium of instruction. Univariate analyses for the effect of grade revealed that both the visual perceptual tests were significantly affected only in grade I and grade II. A further medium v/s grade interaction revealed that visual perceptual scores were affected in children exposed to English medium of instruction of grade I only while, in children

exposed to Hindi medium of instruction, grade I and II both were affected.

Analyses for the combined auditory perceptual tests scores (ARL, AIL and AD) and combined visual perceptual tests scores (VD1 and VD2) revealed both Hindi and English medium of instruction affecting both the perceptual scores; wherein combined auditory perceptual scores (AUD) was affected in grade I and combined visual perceptual scores (VIS) was affected in grade I and II. A further medium v/s grade interaction revealed that in English medium of instruction children, only grade I visual perceptual scores were affected and combined auditory perceptual scores were not significantly affected.

Table 1: Descriptive & Inferential statistics of TDCE and TDCH

Dependent Variable		Mean	S.D.	Sig.	F*
Parameter	Medium				
AIL	Hindi	25.56	.080	.002	10.194
	English	25.92	.080	.002	
AD	Hindi	29.73	.050	.000	13.569
	English	30.00	.050	.000	
ARL	Hindi	25.83	.037	.010	6.914
	English	25.97	.037	.010	
VD1	Hindi	16.11	.082	.000	29.897
	English	16.75	.082	.000	
VD2	Hindi	16.05	.091	.000	19.014
	English	16.61	.091	.000	
AUD	Hindi	81.13	.131	.000	-
	English	81.90	.131	.000	
VIS	Hindi	32.16	.136	.000	-
	English	33.36	.136	.000	

*The F tests are the effect of medium

Paired sample tests were performed on the data set separated according to the medium of instruction as well as each grade wise. In case of grade I, except for the pair between visual perceptual composite score and phoneme grapheme correspondence test (Correlation = -.377; Sig. = .283) significance existed in all the pairs of perceptual and reading related skill tests but none of the correlations was statistically significant. This was same for both the medium of instruction children. In case of grade II, while correlations were statistically insignificant, significance existed in all the pairs of perceptual and reading related skill tests, except for the pair between visual perceptual composite score and phoneme grapheme correspondence test (Correlation = -.153; Sig. = .673) in case of Hindi medium of instruction children only. In case of grade III, the correlation between auditory perceptual composite score and structural analysis test score (Correlation = 0.859; Sig. = .001) was found statistically significant only for Hindi medium children, while in case of the paired test comparisons, significance existed in all the pairs of perceptual and reading related skill tests. In case of grade IV, while none of the

correlations were significant, significance existed in all the pairs of perceptual and reading related skill tests. In grade V, while in case of Hindi medium of instruction children's scores, significance existed in all the pairs of perceptual and reading related skill tests, but in case of English medium of instruction children's scores, the significance didn't exist only between the pair of composite perceptual scores and phoneme grapheme correspondence test (Sig. =.185). A similar pattern was found in grade VI English medium children also, while even in Hindi medium children, the significance didn't exist only in the pair of visual composite perceptual scores and phoneme grapheme correspondence test (Sig. =.114). Hindi medium grade VII children's scores again showed significance in all the pairs of perceptual and reading related skill tests, while in English medium children's, the significance didn't exist in the pairs of composite perceptual scores and phoneme grapheme correspondence test (Sig. =.052) as well as the pair of composite perceptual scores and reading passage scores (Sig. =.087). Finally grade VIII English medium children showed a similar pattern of performance to their grade VII counterparts, but in Hindi medium children the significance didn't exist in the pair of composite perceptual scores and phoneme grapheme correspondence test (level 1 and level 2).

Discussion

This study was designed to study the relation between perceptual abilities and reading related skills. Analyses revealed that data set was homogeneous in the pattern of acquisition of perceptual skills, i.e. the scores on both auditory and visual perceptual sections were poorest in the primary grades, showed a steady increase and finally achieved full scores by around grade IV. But the English medium children were found to have better scores on all the sections of perceptual skills. A study examining skills related to reading in preschoolers from diverse linguistic backgrounds (Chiappe, Siegel, & Gottardo, 2002); found that the acquisition of basic literacy skills developed in a similar manner. In this present study, the differences between the medium of instruction may be considered as being an effect of the relatively poorer socioeconomic status (SES) of the Hindi medium children. Children from lower SES develop academic skills more slowly compared to children from higher SES (Morgan, Farkas, Hillemeier, & Maczuga, 2009). This explains difference observed across all the perceptual parameters, with English medium higher SES children scoring full on the tests approximately two grades earlier than their Hindi medium

counterparts. But all these differences level out in higher grades, at least with respect to perceptual abilities. Molfese, Molfese, and Modglin (2003) concluded that SES was consistently correlated with reading achievement of children of ages 3 to 10. Children from low-SES environments were found to be slower in acquiring language skills, exhibited delayed letter recognition and phonological awareness, and were at a greater risk of reading difficulties (Aikens & Barbarin, 2008). School attended by low-SES communities are often under resourced, which negatively affects students' academic progress (Aikens & Barbarin, 2008). Thus, even the effect of difference of schooling (government and private) existing between the two data groups cannot be undermined.

While gender was found to be a non significant variable, medium of instruction was found to be insignificant only in case of the auditory recall test. Study by Douglas and Montiel (2008) illustrated that poor children begin school with lower skills than wealthier children in recognizing letters, and knowledge of sounds at the beginning and ending of words. But almost all of the children master letter recognition by first grade, while knowledge of sounds at the beginning and ending of words (required for auditory discrimination) still showed a lag by poorer SES children till third grade. A similar pattern of interaction of poorer SES (Hindi medium of instruction) was shown only in the primary grades in this study also.

Pasamanick and Knobloch (1958) and Deutsch (1964) found that low SES children manifested a disproportionately high incidence of visual perceptual deficits. These studies are in accordance with the results of this study which also demonstrates an interaction of the Hindi medium of instruction (lower SES) with visual perceptual scores, while this interaction is limited to just the first grade in case of English medium children. Havaei, Gholamian, Rezaei, Fadayi, and Azam's (2009) study had suggested that visual perceptual skills are affected by cultural and educational issues. Thus, the differences in the present study may be the result of a disadvantaged socioeconomic background or even schooling.

Children in all the grades (grade I to grade VIII) in both TDCE and TDCH, showed a statistically significant relation between all the perceptual parameters and reading related skills. Studies in agreement with this relationship between auditory perceptual skills and literacy readiness skills include Marston and Larkin (1979), Elliott, Hammer, and Scholl (1989), and Corriveau,

Pasquini, and Goswami (2007). King, Wood, and Faulkner (2007) had concluded that the discrimination of visual stimuli develops concurrently with the development of the alphabetic principle.

Research by Hammill and Larsen (1974) found that auditory perceptual abilities were poorly related to reading and Gupta, Ceci, and Slater (1978) also concluded that visual discrimination abilities were not a factor associated with reading achievement. In the current study also none of the correlations between the perceptual and reading related skills were found to be statistically significant in any of the groups or any grade. Thus, the study is in agreement with the current literature, which states that true hierarchical relationships between auditory and visual perception abilities and reading success is ambiguous (Badian, 2005).

But in this study a statistically significant correlation was observed between auditory perceptual composite score and structural analysis test score. Syntactic awareness is the ability to understand the grammatical structure of a language. Deficits in syntactic awareness have been reported in poor readers of English (Tunmer, Nesdale, & Wright, 1987) and other languages also (So & Siegel, 1997).

Phoneme grapheme correspondence was found to have a statistically non-significant relation with perceptual abilities in this study. An early loss of a statistically significant relationship with visual perceptual skills can be explained by the study by Vellutino (1991) who found that visual abilities were poorly predictive of abilities like, word identification, spelling, pseudo word decoding, and reading comprehension at grade levels II to VII. The data of higher grades reveal a progressive loss of relationship between perceptual skills and reading related skills, further shedding light on the probability that the contributions of basic perceptual skills to reading related skills reduces as child approaches higher grades. The development of reading may thus depend partly only on the development of basic visual perception. The relationship between auditory discrimination and literacy success are also not entirely accepted.

Limitations: The cross-sectional design of this study did not permit the examination of the relationship between perceptual abilities and reading through the course of development. The SES factor could not be accurately measured and hence the relationship between private schools and children's educational outcomes may be spurious. Simultaneously, the effect of constant

literacy instruction throughout the course of data collection, impact of home environments related to literacy experiences, instructional differences among teachers, and simply the maturity of the child in the school environment are all factors that were uncontrollable in the present study.

Implications and future directions: The finding that perceptual abilities were related to reading related skills highlights the importance of assessing visual and auditory perceptual abilities in school-age children who demonstrate difficulty in performing educational tasks. Keeping in mind the results of this study may help avoid inaccurate assessment results or clinical reasoning, due to undetected or unsuspected perceptual deficits. The study also throws light on the possible role the medium of instruction and SES plays in perceptual skill development and the strength of its relation with reading related skills. If such critical pre-reading skills are evaluated and discovered earlier, future reading success can be predicted. On the other hand, regarding the decrease of contribution of perceptual skills in higher educational levels and older ages, it is suggested to pay more attention on the effect of other reading related skills on academic performance. These results can be thus used in planning appropriate management strategies for Hindi speaking children with reading deficits.

Data gathered from this study generated several directions for future research. The confounded impact of age, instruction, parental involvement, exposure to reading materials, social-cultural context, early intervention and other similar factors on reading level are ambiguous relationships, which need to be explored. Research studies aimed at examining the burgeoning of language and how language and perception mediates the development of reading in the early school years should be a future research goal.

Conclusions

These results, along with the literature support, emphasize that there are complex patterns between cause and effect in the area of reading and its related skills because learning to read involves many cognitive processes and a breakdown in any one of these may affect ability to read. The results of this study also suggest that a perceptual deficit may hinder reading development in the elementary grades, but in higher grades a more complex interrelation of perceptual and reading related skills exists.

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