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Exploring Causes of Lexical Deficiency in Tertiary Level Learners in Selected Government Colleges in Jaipur District

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ABSTRACT: Lexical processing deficits in students [tertiary level learners] with developmental language disorder (DLD) have been postulated to arise as sequelae of their grammatical deficits (either directly or via compensatory mechanisms) and vice versa. We examined event-related potential indices of lexical processing in students with DLD (n = 23) and their typically developing peers (n = 16) using a picture–word matching paradigm. We found that students with DLD showed markedly reduced N400 amplitudes in response both to auditorily presented words that had initial phonological overlap with the name of the pictured object and to words that were not semantically or phonologically related to the pictured object. Moreover, this reduction was related to behavioral indices of phonological and lexical but not grammatical development. We also found that students with DLD [tertiary level learners] showed a depressed phonological mapping negativity component in the early time window, suggesting deficits in phonological processing or early lexical access. The results are partially consistent with the overactivation account of lexical processing deficits in DLD [tertiary level learners] and point to the relative functional independence of lexical/phonological and grammatical deficits in DLD, [tertiary level learners] supporting a multidimensional view of the disorder. The results also, although indirectly, support the neuroplasticity account of DLD, [tertiary level learners] according to which language impairment affects brain development and shapes the specific patterns of brain responses to language stimuli.

KEYWORDS-Students, tertiary level learners, lexical deficiency, government colleges, Jaipur

I. INTRODUCTION

Students with specific language impairment (SLI) experience difficulties with various lexical processes [tertiary level learners]. This study investigated potential explanations for the lexical semantic difficulties students with SLI face. The underlying deficit causing these difficulties is unknown; these students exhibit difficulty learning spoken words and sentences in the absence of other neurodevelopmental, frank neurological, hearing, emotional or nonverbal intellectual impairments (Leonard, 1998; Tomblin, Records, & Zhang, 1996). Delayed onset of first words is often the first indication of SLI, and students with SLI differ from typically developing peers on estimates of vocabulary size, standardized vocabulary tests, and the number of different words produced in spontaneous language samples (Watkins, Kelly, Harbers, & Hollis, 1995; Bishop, 1997), in selected government colleges in Jaipur district[1,2,3]

Several experimental studies have shown compromised lexical processing in SLI[tertiary level learners]. Students with SLI are slower to recognize words (Edwards & Lahey, 1996) and to name pictures (Lahey & Edwards, 1996; Leonard, Nippold, Kail, & Hale, 1983). Students with SLI also make phonological errors during naming tasks at higher rates than their peers (Lahey & Edwards, 1999). Several studies have shown that on novel word learning tasks students with SLI exhibit difficulties in form-to-meaning mapping (Dollaghan, 1987; Ellis Weismer & Hesketh, 1993; Ellis Weismer & Hesketh, 1996; Oetting, Rice, & Swank, 1995; Rice, Oetting, Marquis, Bode, & Pae, 1994). Students with SLI require as many as two to three times the number of exposures to novel words in order to make gains comparable to their age matched peers (Gray, 2003; Rice et al., 1994). Furthermore, compared to typically developing peers, students with SLI are less likely to retain the newly learned words after a few days have passed (Rice et al., 1994). These students’s form-to-meaning mapping ability has also been found to be more susceptible to external perturbations. Ellis Weismer and Hesketh (1993; 1996) reported more adverse effects of fast speaking rates on novel word learning in students with SLI compared to both the age- and language-matched controls. Alt and colleagues (Alt, Plante, & Creusere, 2004; Alt & Plante, 2006) found that preschoolers with SLI encoded fewer semantic features in novel word learning tasks when compared to typically developing peers, in selected government colleges in Jaipur district

Lexical-semantic deficits

Apart from form-to-meaning mapping in novel word learning paradigms, relatively few studies have investigated lexical-semantic processes in SLI. Marinellie and Johnson (2002) reported that the word definitions of students with SLI reflect a poor understanding of the meaning of common nouns. In a naming experiment by Lahey and Edwards (1999), students with SLI produced more semantically-related errors (e.g. “foot” for “shoe”) when compared to typical peers. These results are consistent with results provided by McGregor (1997). Semantic errors were especially prominent for the students with word-finding deficits in her study, which included participants with a wider range of language, speech and fluency disorders. McGregor, Newman, Reilly and Capone (2002) and McGregor and Appel (2002) further analyzed the relationship between naming errors and the richness of word definitions and drawings representing the meaning of the words. They reported that in both groups, SLI and age-matched peers, small amounts of information in definitions and a lack of detail in drawings were associated with both semantic errors and “I don’t know” responses. Importantly, McGregor and colleagues reported that students’s word definitions and drawings of word meanings yielded consistent results, suggesting that word definitions are a viable window into these students’s meaning representations. In sum, these results indicate missing or sparse lexical-semantic representations in students with SLI. [tertiary level learners], in selected government colleges in Jaipur district[4,5,6]

Even though current theories of SLI[tertiary level learners] have focused on difficulties with language form rather than semantics, these theories provide possible explanations for the sparse lexical-semantic representations. Several investigators have proposed that the underlying impairment in SLI is an auditory perceptual deficit that would result in poor learning of phonological forms (e.g. Merzenich et al., 1996; Tallal & Piercy, 1973a; 1973b; 1975; 1974; Tallal et al., 1996). Other investigators have argued that the underlying impairment in SLI involves a different type of phonological impairment, namely difficulty processing and storing novel phonological information in phonological working memory (e.g. Gathercole & Baddeley, 1990; Montgomery, 1995; Edwards & Lahey, 1998). Given these proposed core deficits in learning phonological forms, a key question in explaining lexical-semantic difficulties becomes, can difficulties in language form result in difficulties learning the meanings of words, in selected government colleges in Jaipur district

Developmental association between word forms and semantics

A growing body of research from typically developing students suggests that learning semantic categories is influenced by whether or not a phonological word form is included in the learning environment. Studies with human infants (Graf, Evans, Alibali, & Saffran, 2007) and connectionist models (Joanisse & Seidenberg, 2003) show that earlier experience with phonological forms facilitates future form-to-meaning mapping. Several experiments have shown that the presence of phonological word forms during different semantic category learning tasks facilitates the learning of novel semantic categories (Balaban & Waxman, 1997; Fulkerson & Waxman, 2007; Waxman & Markow, 1995). There is also evidence to suggest that the presence of word forms can even override nonverbal perceptual categories if the word forms are associated with a semantic category organization that is different from the nonverbal categories (Plunkett, Hu, & Cohen, 2008). Plunkett and colleagues (2008) presented typically developing students with specially constructed pictures of cartoon animals. The visual features of the animal pictures were manipulated such that students exposed to these pictures extracted and learned two visual categories of animals in a learning condition where word forms were not present (e.g. students categorized animals with long necks as one kind and animals with short necks were another kind). However, in a condition where word forms were presented with the pictures, students’s visual semantic learning was different. When the same visual stimuli were presented with a word form that labeled all the pictures with a single category label (e.g. both long and short necked animal pictures were presented with the word “dax”), the students learned only one semantic category (e.g. instead of long necked and short necked animals, students categorized the animals as belonging to the same category). Essentially, the presence of the word from overrode the visual tendency to semantically categorize the animals as two different kinds, suggesting that the presence of word forms has a decisive impact on semantic category learning [tertiary level learners], in selected government colleges in Jaipur district

Since the presence or absence of phonological forms has been shown to impact semantic category learning in typically developing students, and since it has been proposed that the core deficit in SLI[tertiary level learners] has to do with learning phonological forms rather than semantic categories per se, it is possible that factors primarily related to phonological learning underlie difficulties learning lexical-semantics. It is possible that a primary difficulty with phonological word forms results, over the course of the development, in degraded semantic representations, in selected government colleges in Jaipur district

Errors in lexical processing are commonplace in language pathologies resulting from brain injury or disease. This discussion considers some of the major recent developments in the interpretation of such errors. The focus is on behavioral systems, rather than neuroanatomical or neurophysiological issues. The objective is to comment on some plausible mutual implications of generally attested pathologies and normal models of lexical retrieval for production, particularly with respect to the roles of semantic and syntactic categories, in selected government colleges in Jaipur district[7,8,9]

II. DISCUSSION

Words are the building blocks of language. They provide a link between a phonological (or orthographic) form and a referent, resulting in a unit of meaning that can be understood and shared between students. Word knowledge develops early in infancy and before long, students are able to produce and comprehend many thousands of words, using their vocabulary knowledge flexibly and creatively to communicate with others. Words are a crucial component of comprehension, and therefore it is not surprising to find that students who struggle with language during development often have difficulty dealing with words. This is seen most obviously when a child has an impoverished vocabulary: not knowing the meaning of a particular word has clear and detrimental implications for comprehending language which contains that word. For words to drive comprehension however, we need to consider more than whether knowledge of a particular word is there or not. Words and the contexts in which they appear have a close interdependency. A word contributes to the meaning of a sentence but at the same time, the meaning of the word is in part a product of the sentence and context in which it appears. On this view, the possession of vocabulary knowledge for a word is not an all or nothing factor, governed by whether or not a child knows something akin to the dictionary definition of a word. Also important is the ability to retrieve word identities to provide the meaning the listener needs in a given context and to do this rapidly, as the incoming speech stream unfolds in real time.

Word-level deficits are associated with a variety of developmental disorders, most notably developmental language impairment (LI).¹ Before discussing this, it is appropriate to start with a definition of some terms. I use the word lexical in a variety of contexts in this review, including for example lexical knowledge, lexical processing, lexical learning and lexical deficits. At a general level, these terms are associated with word-level aspects of language (with a word comprising something with a mental representation or concept that is associated with a particular form), as opposed to syntactic, grammatical or discourse-level aspects of language. It is harder to specify more precise definitions, not least because terms are used in different ways in the literature. For example, lexical learning might be assessed by asking students to learn a phonological form and associate it with an object that has a novel but meaningless shape. This taps learning the links between a form and its referent, but the demands on the semantic system are quite low, given the object has little meaning. Or, students might be asked to learn semantic attributes associated with a new object or novel phonological form; arguably, this is different to whatever processes are being tapped when students are learning an association between a form and a meaningless referent, quantitatively and in terms of difficulty, if not qualitatively too. How we measure performance is also a complicating factor. Standard laboratory tasks (such as picture naming, word-to-picture matching, providing a definition, word associations or recall of semantic attributes) might claim to measure whether students can identify, recognize or understand words, but in reality, these tasks are not process pure. Putting to one side non-linguistic factors that influence performance such as memory or executive control processes, language is dynamic and interactive—it is not the case that processing can be neatly portioned into components that can be labelled as identification, recognition and understanding.

From this short overview, it is clear that defining and measuring lexical processes is complex. I take a broad perspective here, consistent with the view that lexical skills are multi-faceted, comprising everything a child knows about a word and its usage. The most obvious index of a child's lexical skill is vocabulary knowledge. Put simply, how many words do they know? Accordingly, this review begins by considering this as I review evidence of vocabulary deficits in students with LI. I then consider the nature of lexical learning in students with LI, before turning attention to whether students with LI differ from their peers as they activate, use and process lexical information, in selected government colleges in Jaipur district[10,11,12]

2. Vocabulary knowledge in language impairment

Vocabulary deficits are common but not universal in students with LI. Generally, students who go on to receive a diagnosis of LI are often 'late talkers', indicative of differences in word learning and knowledge from early in development [5]; there is also evidence that vocabulary deficits maintain in later childhood [6,7]. Although it is widely

accepted that students with LI have difficulties understanding words, less clear is how such deficits should be conceptualized, both in terms of their underlying nature, and of their consequences for language comprehension.

A straightforward starting point might be to index the number of words a child knows. Immediately however, we are then faced with the question of what constitutes ‘adequate’ word knowledge and how this is best measured. Vocabulary size is typically estimated using receptive tasks which require students to choose a target referent from an array of pictures. Arguably however, such tasks are not very sensitive [8], leading McGregor et al. [9] to use data from a definitions task to chart vocabulary size longitudinally in 177 students with LI between 2nd and 10th grade (although it should be noted that definitions tasks are not ‘process pure’ as they place demands on expressive skills and executive function as well as tapping word knowledge). Students with LI were able to define fewer words than control students at each time point, with the magnitude of the deficit remaining stable over time. The availability of data from the definitions task also allowed McGregor et al. to make a useful distinction between vocabulary breadth—as described above—and vocabulary depth, referring to how well the students knew the words as estimated from the quality of the definitions they produced. Alongside limitations in vocabulary breadth, students with LI showed reduced depth of knowledge, relative to their peers, and this also maintained over time, in selected government colleges in Jaipur district

McGregor et al.'s finding of deficits in depth as well as breadth is important as it suggests that something about the quality of word knowledge is different in students with LI, not just the quantity of words known. This fits with other observations in the literature. Marinellie & Johnson [10] also reported deficits in the quality of definitions produced by students with LI, both in terms of semantic content and syntactic form; they are also less able to use context to cue multiple meanings of ambiguous words [11]. Students with LI produce fewer semantic associates than their peers, producing instead phonological associates, reminiscent of much younger typically developing students [12]. Even after extensive training designed to enhance semantic knowledge of newly learned words, students with LI were less likely to recall semantic associates of those words (N. Munro 2007, unpublished doctoral dissertation, cited in [12]). Taken together, Sheng & McGregor [12] argued that these findings suggest that students with LI show differences in lexical-semantic knowledge and organization. On this view, LI is characterized not only by fragile knowledge of the core meaning of individual words, but fragile semantic connections between words. Potentially, this will have serious implications for comprehension and language use when lexical processing needs to be nuanced, context sensitive and flexible. I return to discuss this in more detail later in this paper.

3. Lexical learning in language impairment

Given these differences in word knowledge when students with LI are tested at a particular point in time, it is not surprising to see differences in lexical learning in laboratory experiments. Students with LI show poor word learning, both incidentally and over more extended periods of explicit instruction [13–21]. These studies point to difficulties learning new phonological forms, but also with learning semantic attributes such as colour, pattern and animacy. A meta-analysis of word learning in students with LI [22] revealed that lexical learning was impaired relative to age-matched peers, but equivalent to younger students matched for language level (some studies matched using a measure of receptive vocabulary, whereas others used mean length of utterance). Learning was modulated by severity, with students with lower levels of language showing worse levels of learning, and by non-verbal ability. Language group differences were larger when experiments contained more exposure trials (suggesting that controls benefit more from repeated exposure than students with LI), and when learning was assessed via comprehension rather than production.

Lexical learning impairments have traditionally been considered as downstream consequences of impairments in other aspects of language or cognitive skill, with a variety of causal hypotheses being suggested. For example, primary grammatical deficits might impede vocabulary growth as students with LI are less able to use syntactic structure to aid word learning (the so-called syntactic bootstrapping, [23]; see [24–26]). Alternatively, lexical learning deficits might be a consequence of either linguistic or non-linguistic processing limitations, with differences in students' capacity to process, store and retrieve information about new words influencing the ease with which new form-meaning associations are made [27–29]. Importantly, however, there is evidence for the causal nature of the relationship operating in the opposite direction—that is, vocabulary knowledge itself contributing to phonological short-term memory ([30] and see [31] for a computational model that addresses causal relationship between phonological short-term memory and vocabulary learning).

A rather different perspective on the nature of lexical learning deficits comes from the procedural deficit hypothesis (PDH; [32]). This proposes that language learning is supported by two memory systems, declarative and procedural. Declarative memory comprises the mental lexicon—a store of memorized word-specific knowledge—and is thus associated with vocabulary acquisition and semantic knowledge. By contrast, procedural memory is akin to the mental grammar and deals with syntax and phonology—computational aspects of language that in this approach are considered to be rule-based. According to the PDH, LI is associated with deficits in procedural memory but an intact declarative system. On this view, vocabulary is seen as a relative strength in LI as it is primarily supported by the declarative system. At the same time, however, the hypothesis recognizes that some degree of vocabulary deficit is often observed in LI, but states that this is a consequence of procedural deficits. Here, procedural deficits would impede lexical learning, with the learning and retention of phonological sequences being particularly vulnerable. Consistent with this idea, students with LI show deficits in procedural learning in both linguistic and non-linguistic domains [33,34] and these might be directly related to grammatical skills [35]. Less clear is whether the declarative system is intact as Lum et al. [33] also reported impaired declarative learning for verbal materials, as well as impaired procedural learning.[13,14,15]

The PDH discusses one type of implicit learning, procedural learning. Another form of implicit learning has been described in the statistical learning literature and this also provides an alternative perspective on lexical learning in LI. In statistical learning tasks, learners are exposed to a stream of elements that contain regularities, for example, one syllable reliably predicting the occurrence of another syllable. Even young infants are adept at tracking such statistical regularities (e.g. [36]) and at using this knowledge implicitly in ways that are relevant to language, for example, identifying word boundaries in continuous speech. Moreover, infants are able map the outputs of statistical learning (e.g. potential word forms) to referents and to lexical categories, without explicit instruction or reinforcement [37–39], consistent with statistical learning having a role to play in natural language development (for a review, see [40]). Building on this work examining statistical learning and language learning in typical development, Evans et al. [41] asked whether students with LI showed differences in statistical learning, relative to age-matched controls. Students engaged in a drawing task while passively listening to 21 min of continuous speech comprising a novel language. Embedded in the speech were ‘words’, identifiable as such by virtue of having high transitional probability (i.e. the probability that one syllable would follow another, thus providing a cue as to where word boundaries could be placed in the speech stream). At test, students were played ‘words’ and ‘nonwords’ and made a judgement as to which sounded most like the sounds they heard while drawing. The LI students were worse than the controls, and their performance was not different to chance levels. In a second experiment, doubling the amount of exposure improved learning in the LI group, who now showed performance significantly better than chance. Interestingly, the students with LI were also poor at detecting statistical regularities in a non-linguistic condition comprising tones, in selected government colleges in Jaipur district

Much more work is needed to clarify when and why students with LI perform less well on statistical learning tasks. An exciting prospect for future research will be to extend the investigation of statistical learning in LI from the identification of word boundaries to the mapping of form to meaning. Recent developments in psycholinguistics have shown that learning to map words to meaning is a statistical learning process [42–45]. This approach has the potential to help us understand more about the nature and origins of individual differences in lexical learning. We also need to consider the similarities and differences between implicit learning, as embodied in the statistical learning literature and procedural learning. If word learning is the product of statistical learning mechanisms [42], it is more appropriately seen as part of the procedural system, rather than the declarative system. Discussion of the similarities and differences between the PDH and implicit or statistical learning is beyond the scope of this paper but can be found elsewhere [46,47].

Regardless of how we characterize the causes of lexical learning differences in LI, what is clear is that students with LI are poor at learning new words and this might lead to meaning being represented in long-term memory in an impoverished way, lacking in elaboration and connectivity between items and therefore resulting in vocabulary knowledge that is deficient in quality as well as quantity. As noted earlier, this has serious implications for comprehension which both depends on and stems from the activation of appropriate aspects of word meaning, given a particular context and nuance. To examine this possibility directly and in more detail however, we need to move to studies that measure lexical knowledge in a very different way.

4. Lexical processing in language impairment

As noted earlier there is a close interdependency between words and the contexts in which they appear, with words contributing to the meaning of the sentence while at the same time gaining some of their own meaning from the sentence context. Clearly, methods that tap word knowledge in isolation are not sufficient to capture this complex interplay. An alternative way to conceptualize a child's word knowledge is to measure how they use and respond to words during the course of language processing. A large body of work in psycholinguistics has taught us a great deal about how listeners access and recognize spoken words, and we know a number of features that characterize this in adults (for reviews, see [48,49]). McMurray et al. [50] summarize key features as follows: (i) words are activated immediately upon receipt of the smallest amount of perceptual input, (ii) activation is updated incrementally as the input unfolds, (iii) activation is graded, (iv) multiple words are activated in parallel, and (v) these words actively compete during recognition. While there is more to understanding the meaning of words than how spoken words are initially activated and recognized (see [51,52] in this volume for discussion of semantics and conceptual knowledge), the properties of lexical access and spoken word recognition identified in studies of adults provides a framework to help us think about aspects of word knowledge in students with LI, and indeed in typical development [53,54]. Put simply, do students with LI show any qualitative or quantitative differences in any of these core features of word recognition?

A method that has been used productively to explore the key features of word activation and recognition in adults is the visual world paradigm [55,56]. Here, eye movements are measured as participants view a visual scene (which might comprise an array of real objects or objects presented on a computer screen). At the same time, they are listening to spoken stimuli that describe aspects of the visual scene. As students tend to look at objects that serve as potential referents for the linguistic expressions they hear, monitoring eye movements can tap language processing, as it unfolds in real time. This method holds considerable promise for exploring language processing in students, especially those with developmental disorders [57], as it requires no secondary task or complex instructions, or verbal output. Instead, eye movements are monitored unobtrusively as students hear speech, allowing a relatively implicit measure of processing as it happens.

Although few in number, studies using the visual world paradigm to explore language processing in students with LI have offered some important insights. McMurray et al. [50] monitored the eye movements of adolescents with LI to a set of visual scenes, each containing four objects: a target (e.g. candle), a cohort competitor (e.g. candy), a rhyme competitor (e.g. handle) and an unrelated item (e.g. button). We know that adult listeners show a systematic pattern of eye movements towards the objects, as the speech stream containing the target word unfolds in time [56]: about 200 ms after the onset of the target word in speech, equivalent looks are seen to the target and cohort competitor, and both are fixated more than either the rhyme and unrelated distractors. As the speech stream continues and the ambiguity between target and cohort is resolved, looks to the cohort competitor decrease, accompanied by a small increase in looks to the rhyme competitor. These findings demonstrate the fine temporal properties of the paradigm, and its ability to chart key features of word recognition such as immediacy, gradation and competition. With these findings as a backdrop, McMurray et al. [50] explored the eye movement record of adolescents with LI and asked if, when and how it differs from that of control students. Initial activation was normal, but later in the time course, reduced language ability was associated with fewer looks to the target and more looks to the cohort and rhyme competitors. They used TRACE [58] to model the data and test out a number of hypotheses as to the possible cause of this atypical pattern of eye movements. The best fit to the data came from modelling variation in lexical-level factors, rather than perceptual or phonological factors. Specifically, increasing lexical decay in the model best captured the data, leading McMurray et al. to suggest that high levels of lexical decay prevent the target word from being fully active, thus allowing competitors to become more active than they ought to be.

These findings point to differences in word recognition in students with LI that have a lexical locus and a relatively late time course in processing. Additional support for this comes from an experiment reported by Munson et al. [59]. This experiment was designed to measure sensitivity to small acoustic differences during the course of spoken word recognition. Previous work with adults [60] revealed that listeners are sensitive to small variations in voice-onset time (VOT) within a phonemic category (i.e. different tokens of /b/, some of which are closer in VOT to a /p/) and that this is revealed in their eye movements as they look at a scene containing pictures of a beach and a peach, among other items. Specifically, more looks are made to the competitor picture (e.g. peach) as the acoustic signal becomes closer to a /p/, even though listeners still categorize the token as a /b/. Consistent with an increase in lexical decay, Munson et al. found that adolescents with LI were more likely to fixate competitors than control students, and this showed a linear

relationship with the magnitude of the LI. Importantly, however, the language impaired group showed equivalent sensitivity to fine-grained variation in VOT, suggesting no deficits in perceptual or phonological processing. Taken together, the findings of McMurray et al. [50] and Munson et al. [59] point to students with LI showing increased levels of lexical uncertainty. This does not seem to be a consequence of differences in initial activation but instead seems to reflect later components of processing associated with selecting between competitors.

So far, I have discussed studies that explore the processing of words (and competitors) in isolation. In natural language however, words are usually encountered in sentential contexts. Recent studies using the visual world paradigm with adults have explored how the cohort effect manifests when words are processed in contexts that serve to constrain meaning. Building on earlier work in adults [61], Brock & Nation [62] monitored eye movements as adults heard a target word (e.g. button) in neutral versus constraining context (Joe chose the button versus Joe fastened the button) while viewing a visual scene that contained three distractor pictures and a competitor picture, in this example, some butter. As expected in the neutral condition, listeners looked preferentially to the cohort competitor after the acoustic onset of button. This effect was significantly reduced in the constraining condition, where the verb fastened made the competitor an unlikely referent. The availability of contextual information had a near immediate effect on word identification, operating with a similar time course to the cohort effect itself.

Relevant to our discussion of LI, Brock et al. [63] explored this context-on-cohort effect in students with autism, using the visual world paradigm. They found no effect of autism diagnosis: students with autism, like the control students, showed exactly the same effect seen in adults, with context serving to block the cohort competitor effect. Importantly however, students with low levels of oral language (including some students with a diagnosis of LI, with or without autism) showed reduced sensitivity to context: when listening to Joe fastened the button, they spent longer looking at the contextually inappropriate competitor (butter) than students with better language skills, consistent with McMurray and colleagues' findings of increased looks to competitors in adolescents with LI.

Although not yet tested in students with LI, Huang & Snedeker [54] present data from typically developing 5-year-old students that also point to competition effects lasting longer when language skills are relatively weak. Using the visual world paradigm, adults and students viewed scenes containing a target picture (e.g. logs), a competitor (e.g. key) and two unrelated distractors while listening to a neutral sentence that contained the target word (e.g. pick up the logs). The rationale here is that logs should activate the (non-present) phonological competitor locks, leading key to be activated, via its semantic association with lock. If listeners are sensitive to this, they should look more to the key than either of the distractor pictures. This is exactly what Huang and Snedeker found, both for adults and 5-year-old students, replicating earlier reported effects with adults [64]. In addition, competition lasted longer for the students, and they occasionally made errors that involved them selecting the competitor rather than the target—an error not made by adults. These data show that students, like adults, show incremental activation across multiple levels of representation, with partial speech input activating candidate lexical items in terms of form and meaning. Importantly however, students are less adept than adults at using subsequent phonological information to rapidly suppress or rule out the phonological-semantic competitor.

To summarize these four visual world paradigm studies: all show that participants with low levels of language (adolescents with LI in [50,59]; older students with LI, with or without autism in [63]; typically developing 5-year-old students in [54]) show competition effects, consistent with the general core properties of lexical access and spoken word recognition outlined earlier. In all four studies, however, competition effects lurked for longer in individuals with lower levels of language skill. It is worth noting that competition-like differences in students with LI have been described in studies using other methodologies such as semantic priming and lexical ambiguity resolution [65–67], gating [68], word spotting [69,70] and delayed repetition [71,72]. Taken together, these observations provide converging evidence and reassurance that prolonged competitor activity is unlikely to be an artefact of the visual world paradigm.

What might these findings mean for sentence comprehension? As semantic analysis begins very early in processing, before word recognition is complete, one can speculate as to how variation in lexical processing (for example, slowness in settling on a single candidate) might have direct consequences for higher level aspects of sentence comprehension. And, if multiple candidate words remain activated simultaneously, the system might get overloaded or bottlenecked, leading to difficulties in syntactic parsing and semantic interpretation. These are underspecified speculations and direct evidence is lacking, but nevertheless, the general notion that inefficiency or uncertainty at the lexical level serves to impede comprehension makes sense. Clearly however, and as noted earlier, studies examining lexical access and

spoken word recognition explore the initial inroads into comprehension. Much more work is needed to uncover how the lexical–phonological interactions seen in these visual world studies contribute to (and are influenced by) sentence and discourse comprehension, in selected government colleges in Jaipur district

5. Linking lexical learning and lexical processing

Learning and processing are generally considered separately in the literature. In reality, however, the two must be intertwined: a processing episode with a word will be influenced by an individual's previous experiences with that word; in turn, the episode will provide a new encounter to add to the accumulated knowledge the individual has of that word, and so influence future processing. Differences in vocabulary size early in development matter as this will influence the statistical properties that are extracted from the input (see [73] for evidence) and in turn, this will serve to influence subsequent learning and processing.

Experiments with adults show that newly learned words soon integrate with existing knowledge and begin to compete with similar sounding words in online processing [74]. Henderson et al. [53] recently extended these findings to 7–8-year-old students. Here, students experienced new words that were competitors for existing words (e.g. biscial for the base word biscuit). Following a period of consolidation, online processing of biscuit was slowed, indicating that biscial had become sufficiently integrated so as to induce lexical competition. Interestingly, students showed larger lexical competition than adults, reminiscent of the increased competition effects seen in students with LI in experiments using the visual world paradigm. Also, as reviewed earlier, students with LI also show difficulties with consolidating vocabulary [21,22] in laboratory learning tasks. Extending experiments that unite learning and processing, like Henderson et al. [53] to students with LI offers rich potential for revealing a great deal more about how differences in learning are related to differences in online processing. This is nicely illustrated in a recent study by McGregor et al. [75]. Adults with LI were asked to learn new phonological forms and map them to novel meanings. In addition to measuring encoding skills relative to a typically developing group of adults, learning was assessed following a period of consolidation. The LI adults were poor at learning both form and meaning, encoding less information than control participants; interestingly however, they retained knowledge about meaning over time, but their ability to recall new forms declined over time. Both encoding and remembering were associated with the severity of LI, with those with the most severe deficits in language showing poorer levels of learning. This experiment shows the utility of separating different aspects of learning (encoding versus remembering; form versus meaning) and probing learning over time. Future work could build on this empirical approach and make links with the literature on learning [36–45].

Another way to consider the complex interplay between learning and processing is via computational modelling. This is nicely illustrated by McMurray et al.'s [42] dynamic associative model of word learning. Both learning and processing are implemented in the model: learning is accomplished by changing connection weights between words and objects whereas processing is activation in real-time across those weights. In associative accounts, we often think of the need to learn stimulus–response mappings from explicit encounters with words and their referents. The enormity of word learning is traditionally seen as a problem for such accounts. However, if we consider that each learning encounter not only strengthens the mapping between a word and its referent, but also suppresses or reduces irrelevant mappings to all other referents, we see that much more can be learned during each encounter. This process is slow, but McMurray et al. make a persuasive case that word learning is slow. For students with LI, this process will be slower still. The observation that the model's ability to suppress or 'prune' unnecessary or incorrect associations was an important determiner of learning (which in turn impacted on real-time processing) might have relevance to LI. Simulations showed that the pruning of unnecessary connections drove the system both to learn new words, and to recognize them faster. During processing, unnecessary connections caused auditory input to activate multiple lexical units, which then competed. For students with LI, reduced vocabulary size might be associated with more spurious associations, which would then lead to more competition during processing, and a reduction to the learning power of that encounter. This is speculative, but could be tested by combining modelling efforts with online data from students at different points in development, and with LI, in selected government colleges in Jaipur district

6. Lexical differences in language impairment: cause or consequence?

Issues of causality are complex. To help frame this discussion, it is helpful to consider two distinctions: proximal versus distal causes and domain-specific versus domain-general explanations. A proximal cause is situated close to the observed behaviour—something awry that directly contributes to the disordered behaviour. We can, for example, posit a cognitive model of spoken word recognition that has a particular component and if students with LI show impairments in this component, this would be an adequate proximal cause of differences in spoken word recognition.

Taking a more distal view allows us to ask why it is students come to be impaired at processing that component, with a distal cause being the ultimate or underlying cause of the disorder. A domain-specific explanation would be specific to the language system, whereas a domain-general explanation would look beyond language and ask whether deficits in other domains are responsible for the language deficit.

One can certainly make a plausible case that differences in lexical learning and lexical processing are causally implicated in LI. At a proximal level of explanation, a case can be made that sentence comprehension has a lexical basis [76]. On this view, differences in lexical processing have a direct impact on ongoing comprehension. Thus, differences in lexical skill will impact on language processing more generally, with word-level deficits influencing sentence and discourse comprehension. Taking a more developmental perspective, early in development, if grammar emerges from a lexical base [77,78], limitations in lexicon size will be critical. This point is nicely made by Locke, who said of students with deficits in lexical knowledge: ‘For them, a lexicon delayed may be a grammar denied’ [79, pp. 281–282]. Others have argued that lexical deficits are a consequence of more primary deficits in other aspects of language. Both morphosyntax and phonological short-term memory feature in causal theories that predict lexical sequelae, for review, see [80].

Turning to issues of domain specificity, it might be that apparent language differences stem from non-linguistic sources. For example, there is a sizeable literature exploring the extent to which LI is a consequence of auditory processing deficits and these do seem to be associated with elevated risk of LI, even if they do not play a simple causal role [81,82]; studies have also explored the hypothesis that LI is associated with impairments in processing speed [83]. Parallels to the literature on acquired disorders [84] can be seen if we consider LI stemming from impairments in cognitive control. Students with LI often show concomitant deficits in executive function and these might influence the processes involved in lexical activation or selection, e.g. [85]; developmentally, there is a close relationship between language and the development of cognitive control [86] but once again, cause and effect are difficult to discern: limitations in cognitive control might limit language development but equally, language might also limit the development of cognitive control. The PDH described earlier can also be seen as a domain-general theory, as can differences in associative learning, inherent in McMurray et al.'s [42] computational model of word learning.

It is clear that discerning causality is very difficult indeed. The distinction between proximal and distal is not clear cut (see [87] for further discussion) and how relevant pinpointing causality is to our understanding of the lexical nature of LI depends very much on the particular question being asked. If one is interested in underlying causes—what is the nature and origin of LI—then one needs to ask how language difficulties emerge from the genetic and environmental etiological factors that place students at risk for LI. Over recent years, there has been a move away from thinking about causality in terms of one underlying cognitive cause with current theories considering how different cognitive factors might operate together in a probabilistic multi-risk fashion, rather than debating ‘the’ single or primary underlying cause [88]. This perspective has development at its heart and offers a fruitful way to consider how cognitive-level factors interact and influence each other, as learning happens (see [80,89] for an overview). Within this framework, we can consider how lexical deficits emerge from whatever it is that places a child at risk of LI, while at the same time recognizing that lexical differences themselves will also contribute to the ongoing developmental manifestation of LI.

An understanding of causality within a multiple and probabilistic risk factor model is needed if we are to understand the complexity of gene–brain–behaviour relationship in LI. Equally though, to address theoretical questions in language processing or individual differences in language processing, there is space for more proximal questions to be asked about how words are learned and processed in students with LI. These can be addressed in terms of the cognitive processes involved in language processing (behaviourally or computationally) while remaining agnostic about the etiology and ultimate causes of LI. The empirical and computational work reviewed here demonstrates the utility of this approach [14,15,16]

III. RESULTS

The findings showed that the students still faced the problems or difficulties in vocabulary learning. Kinds of difficulties faced by students in vocabulary learning were various. Kinds of difficulties faced by the students were (1) almost all of the students have difficulties in pronouncing the words, (2) how to write and spell, (3) the different grammatical form of a word known as inflections was one of causes of students difficulties in learning vocabulary. In addition, (4) the students found difficulties in choosing the appropriate meaning of the words and (5) also still confuse in using the word based on the context. The last, (6) the students were also still confuse when they found words or

expression that were idiomatic. There were some factors that caused students' difficulties in learning vocabulary (1) the written form is different from the spoken form in English, (2) The number of words that students need to learn is exceedingly large, (3) the limitations of sources of information about words, (4) The complexity of word knowledge. Knowing a words involves much more than knowing its dictionary definition, (5) causes of lack of understanding of grammatical of the words, (6) the incorrect pronunciation is often caused by the lack of sound similarity between English and the students' native language, in selected government colleges in Jaipur district

One factor causing this poor performance is a lack of lexical development among students. The present study sought to investigate the impact of inadequate teacher training on students' lexical development using secondary data from existing research on teacher training in Jaipur and the lack of attention to methodology, particularly in the context of vocabulary teaching. The results revealed that more attention is given to grammar than vocabulary, which negatively impacts lexical development among learners in high schools when undertrained teachers do not have the requisite competence to equip students with the skills for vocabulary learning. The study lays the foundation for a more empirical approach through research methods that can produce generalizable findings. It also provides recommendations that have critical implications for stakeholders in the education sector, extending from teacher training institutions and academia to policy makers and curriculum developers in selected government colleges in Jaipur district[17,18,19]

IV. CONCLUSION

We examine the lexical abilities of students with specific language impairment (SLI). These students exhibit a significant deficit in language ability, yet show no evidence of obvious neurological impairment or significant limitations in nonverbal intellectual functioning. In addition, the hearing of these students is within normal limits, and they provide no indication of serious emotional difficulties. Examination of the nature of the students's lexical limitations suggests that the students's lexical networks are organized in a generally appropriate manner at the lexical concept, lemma, and lexeme levels. However, these networks are relatively sparse, and resting activation levels of the entries and the links among entries are relatively weak. The sparse network has implications for grammar as well as for the lexicon. For example, incomplete or weakly represented information at the lemma level can lead to sentences with missing constituents. Lexical limitations--especially those pertaining to verbs--will cause problems for syntax as well. Nevertheless, a close look at the students's verb-related difficulties suggests that lexical limitations can only be part of the problem. Independent difficulties with syntax seem to exist alongside lexical limitations, in selected government colleges in Jaipur district[20]

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