Supporting adjective learning across the curriculum by 5-7 year olds:**Insights from psychological research**

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Supporting adjective learning across the curriculum by 5-7 year-olds:**Insights from psychological research****Abstract**

Adjectives are a powerful tool for enriching vocabulary and developing conceptual understanding. In early elementary and primary classrooms, across core and foundation subjects, children are expected to describe, measure, classify, and compare objects and events - all processes that require a mastery of adjective meanings and use. While teachers are trained in vocabulary learning, they are likely to be less familiar with the psychological processes by which children learn adjectives, and how attention to adjectives can support further learning in domains outside of language and literacy lessons. To address this gap, we have collaborated as a unique interdisciplinary team with linguistic, psychological, and pedagogical expertise, to synthesise research across our disciplines to provide an accessible evidence-based, practical primer of relevant research findings on adjective development. We then provide clear guidance on how these findings can be leveraged to enhance current teaching and learning practices across subjects for children aged five to seven.

Keywords: adjectives, vocabulary, word learning, primary education, language and literacy, research-practice collaboration

1. Introduction

In language and literacy lessons, children are taught to use adjectives to enrich their spoken and written language – to engage their audience by, for example, pointing out not that there’s something on their shoulder, but *something wriggly, bristly, or alien*. Adjectives and other forms of descriptive language increase children’s narrative competence by providing nuance for both referential and evaluative aspects of storytelling, and for their skills in reading comprehension (Griffin et al., 2004). Although teachers are trained in strategies for integrating new vocabulary into children’s existing repertoires, they are less likely to have received specialised instruction in how children acquire adjectives, and how these findings can be used to support children in expanding their mastery of adjectives across a range of curriculum areas. For example, knowing that the use of comparison sets or antonyms can support children’s expanding repertoire of adjectives in literacy, or understanding the links between children’s talk about extent or quantity and the teaching of mathematical concepts. Research in developmental psychology and linguistics has produced a wide range of findings on preschoolers’ adjective development, with potential for application in the classroom.

However, collaborations focusing on the implementation and evaluation of linguistic research in pedagogy are still in their infancy (though see a recent report on how cognitive science can be used in the classroom to boost learning outcomes; Perry et al., 2021). This paper, which integrates the theory and practice of adjective learning, emerges from a two-year collaboration between a team of linguists, developmental psychologists, and teacher educators working in UK and US universities. It is underpinned by extensive consultation with a wide range of teachers and other educational practitioners working in primary schools and early years settings, most notably via the online professional development workshop [BLINDED FOR REVIEW] held in 2021 (all materials available online). Following this workshop, we were commissioned by the [BLINDED FOR REVIEW] SCITT (School-

Centred Initial Teacher Training) programme to create a training video on adjective development. The video was an accessible version of the current paper and has reached around 25 trainee teachers so far.

Through this paper we demonstrate our approach to research-to-practice partnerships. We do this practically, by providing an accessible primer of research findings on adjective development (section 2), with clear guidance on how these findings can be applied in classroom settings in both England and the US (section 4). The paper is intended for use by practitioners directly, as well as acting as a case study for researchers to draw from in their own intersectoral collaborations.

1.1 The importance of adjectives in early cross-curricular education.

In the early years of primary education, children learn common adjectives, their meanings, and their usage as part of their language and literacy curricula. For example, in the English system at Key Stage (KS) 1 (years 1-2; 5-7 years old), children learn how to modify adjective meaning by adding prefixes and suffixes (DfE, 2014). By the end of Year 1 (age 5-6), children are expected to know that the prefix *un-* can change the meaning of an adjective to its opposite. By the end of Year 2 (age 6-7), they should know that the suffixes *-er*, *-est*, *-ful* and *-less* can be used to compare entities and refine descriptions. Likewise, in the US system, the Common Core State Standards state that kindergarteners (age 5-6) and first graders should be able to demonstrate command of adjectives by relating them to their opposites (antonyms), and children in first and second grade (6-7 years) should be able to demonstrate a command of the conventions of standard English grammar and usage when writing or speaking, which entails using frequently occurring adjectives; distinguishing between adjectives and adverbs; and recognising nuances among terms (NGACBP & CCSSO, 2010a).

See Figure 1 for a comparison of curriculum targets for language and literacy in England and the US.

Figure 1. Examples of Language and Literacy standards that require adjective knowledge in England and US.

The importance of adjectives goes well beyond language and literacy instruction. For example, the national curriculum framework in England states that (English) language is both a subject in its own right and an essential foundation for success in all subjects (DfE, 2014). Likewise, the US National Academy of Sciences Science Teaching Standards says that ‘Developing communication skills in science and in language arts reinforce one another’ (NRC, 1996). Two of the core subjects where descriptive language is crucial for academic

success are mathematics and science, but it is also relevant in history, social studies, and the arts. For example, several objectives in KS1 maths require children to use language to describe, compare, and measure capacity, length or height (DfE, 2014). A core objective in science is for children to explore and describe the properties of materials (DfE, 2014; NRC, 1996). In art and music, children are required to explore different materials, colours, and melodies, and to use language to describe disciplines, practices, or techniques and to compare and categorise images and the expressive qualities of music (NCCAS, 2014). In geography and history, children need to be able to describe and compare locations or historical events. Thus, for academic success across all subjects, a firm understanding of adjective meanings and their various morphosyntactic forms (i.e., their internal structure and how they can appear in sentences) is not only advantageous, but required.

The usefulness of adjectives across the curriculum means that children would benefit from support to develop this word class in *all* of their subjects. We argue for expanding the explicit teaching of adjectives beyond language and literacy classes, and explore practical methods to support adjective learning across core and foundation subjects (section 4). Using topics from specific curriculum areas, we propose activities through which adjectives can be taught. We build on the small amount of published research (e.g., recommendations to use real objects in science classes to teach descriptive vocabulary such as *solid*, *fragile*, and *cylindrical*; Rule et al., 2004). By giving practical suggestions underpinned by their psycholinguistic rationale, we provide a guide that is both rigorous and accessible, and which should enable children to confidently use descriptive language across academic subjects and into their lives outside school.

In sum, this article supports practitioners in teaching descriptive language across the curriculum, and demonstrates to researchers wishing to engage with school communities a model of one approach to collaboration. We provide a review of what psychological and

linguistic research reveals about the acquisition of adjectives in early childhood (section 2). As a baseline for our suggested curriculum developments, we outline current approaches to adjective learning in KS1 classrooms (section 3). Section 4 demonstrates how research can be applied to enhance adjective learning in class across curriculum areas, together with recommended resources to support these ideas. Our work builds on foundations from Ricks and Alt (2016), who proposed to apply theoretical principles and experimental findings from research on adjective learning to support children who struggle with acquiring adjectives (see also Davies et al., under review). We expand this by harnessing the research findings to support a wider range of children starting out in formal education to reach a more sophisticated mastery of adjectives across a range of subjects.

2. What does research from linguistics and psychology tell us about how adjectives are acquired by young children?

This section gathers together some of the fundamental research findings on young children's adjective development and presents them for practitioners to use as a foundation for devising classroom activities. Some of the experimental paradigms are illustrated by screenshots from our teacher training resources, which highlights that even the simplest of images when carefully crafted can be highly useful pedagogical tools..

In formal education, children are taught that adjectives modify nouns, and that they carry a specific kind of meaning that describes the properties of animate and inanimate entities. Interestingly, while prelinguistic infants struggle to recognise that differences between entities distinguish them (Xu & Carey, 1996; Xu et al., 2004), just a few years later, 3-4 year-olds are adept not only at noticing contrasting properties of objects, and — even prior to any formal training in school — rapidly assigning meaning to new adjectives. What does experimental research tell us about what young children know about adjective meaning

and the conditions under which they are able to acquire it? Here we focus on three aspects: the fact that adjectives depend on context for their meaning, the role of comparison and contrast in adjective learning, and adjectives' relationship to nouns. This review establishes a foundation for our recommendations for pedagogical and curricular support focused on adjectives (section 4).

We begin with Figure 2, which illustrates some of the terminology used in this section. Objects can be organised into CATEGORIES according to their kind (e.g., animals; dogs). Each member of the category is an EXEMPLAR. Objects can be grouped together at different LEVELS of the category, based on conceptual similarity among exemplars.

Figure 2. Object categories, levels, and exemplars.

2.1 Some adjectives rely on context.

Shape is an especially salient property to children, as opposed to colour, texture, or size (Gelman & Ebeling, 1998; Jones & Smith, 1993; Landau et al., 1988; 1998), and children are

SUPPORTING ADJECTIVE LEARNING BY 5-7 YEAR-OLDS

adept at using it to learn new adjectives and nouns - perhaps because it is a reliable and stable cue to object function or category membership. This does not mean children are unaware of context-dependent properties such as size or colour; it's just that these are more challenging in that they require additional contextual support. To assess whether or not something is *big* or *high*, children must refer to different types of standards. For example, to decide whether a container is *big* requires them to assess how big a typical object of that kind is relative to a comparison class, and relative to other examples of the same category co-present in the context, to the location of other objects, or its intended function (Ebeling & Gelman, 1998; Gelman & Ebeling, 1989). This line of research highlights the fact that adjectives are difficult or even impossible to learn in isolation: context is key.

Children know that adjectives depend on context in different ways. Because 4-year-olds classify all objects that are bigger than the mean average of a set as *big*, we know that they understand that scalar adjectives such as *big*, *long*, or *tall* set the standard around the midpoint of a series, e.g. Figure 3 (Gotowski & Syrett, 2020; Syrett et al., 2006). What's more, manipulating this context by adding more objects has clear effects on where children set the standard and whether they allow adjectives like *tall* to apply to an object. Crucially, this manipulation only has an effect if children treat these additional objects as belonging to the same object kind (Barner & Snedeker, 2008). Thus, young children use contextual cues to apply adjective meaning flexibly.

Figure 3. Series of objects in descending height, with midpoint highlighted.

2.2 Comparison and contrast support word learning.

Adjectives often imply a contrast between members of a category, e.g., a big vs. a small cup. Horowitz and Frank (2016, exp. 3) demonstrated that children are able to make this subtle inference before they start school, and can distinguish between adjective types. As Figure 4 illustrates, they showed children a novel object that instantiated two properties (a funny-shaped object that was both tall and dirty) and told them, “This is a *special kind* of zib. This one is a {TALL/DIRTY} zib!” They then presented children with two new objects of the same category (one was tall and clean, and the other short and dirty), and asked what most zibs look like, forcing a choice between the two. Four-year-olds (but not 3-year-olds) selected the correct contrast object, i.e., the short one when they had been shown that the special one was tall - but this worked for the size adjective only if they were told the first zib was a ‘special kind’. Their choice of object indicates that they take the prenominal adjective to signal contrast relative to a default for that exemplar and its corresponding category.

This is a (special kind of) zib, This is a tall zib.

What do you think zibs usually look like?

Figure 4. Example paradigm from Horowitz and Frank (2016, exp. 3).

190 The role of object category (e.g., whether something is an animal or a toy) turns out to
191 be extremely important in adjective learning. Seeing multiple exemplars of a category while
192 hearing an adjective highlights the commonalities between the properties of these objects,
193 e.g., the fact that they are all red or fuzzy. Importantly, children (much like prelinguistic
194 infants) don't notice these properties just by looking at the array; the adjective label
195 *highlights* the similarity, inviting categorization. When children hear an adjective describing
196 these properties — even an entirely novel one — they are better able to deduce its meaning
197 and generalise it to new objects (Klibanoff & Waxman, 2000). But this 'cross-situational
198 learning' is nuanced: it works for objects of the same basic level but not at a higher level of
199 the taxonomy, e.g., for dogs, but not for animals in general (Klibanoff & Waxman, 2000).
200 However, if children are first allowed to extend properties to new objects of the same basic
201 level, and *then* move across categories (e.g., duck to more ducks vs. duck to turtles), they
202 succeed, demonstrating that the level of comparison within and among categories influences
203 their attention to object properties (Klibanoff & Waxman, 2000).

204 Because children's inclination to treat words as labels for object categories is potent
205 for both nouns and adjectives from the earliest stages of development (Waxman & Markow,
206 1995), there are times when children actually perform better given an across-basic-kind
207 contrast. This appears to be the case when they are learning adjectives that describe
208 properties that are less visual and more tactile (e.g., *lumpy*). In these cases, when children are
209 taught that a cat toy is lumpy, they are better able to select the lumpy target when shown two
210 turtle toys, than when they are shown a rabbit and a cat. They do especially well when the
211 teaching of the adjective is accompanied by gestures that highlight the tactile property
212 (O'Neill et al., 2002).

213 Children are also more likely to succeed if they are initially provided with two objects
214 to explicitly compare and contrast, before being asked to extend the adjective to new objects

across categories. For example (as Figure 5 illustrates), when children are shown objects with contrasting properties (e.g., two plates with different textures) and told “*This* one is a very wuggish one but *this* one is NOT wuggish” and are then asked to find another wuggish one from a new set of objects of a different category (e.g., tubes), they are able to do so - but only if they start *within* basic-level categories (e.g., multiple plates) not across (e.g., a plate vs. a sword). However, when children are told “*This* one is a very wuggish one and *this* one is ALSO wuggish” and asked to find another wuggish one from a new set, they are now able to do it *across* basic-level categories, but not within (Waxman & Klibanoff, 2000). Thus, contrast *within* category and similarity *across* categories is key. Importantly, if children are asked to “find another one,” they are not able to extend the adjective meaning. For size terms like *big*, children benefit from this category of explicit comparison of properties in a set to acquire novel size adjectives (Ryalls, 2000).

Figure 5. Example paradigm used by Waxman & Klibanoff (2000).

2.3 Children know that adjectives modify nouns.

Unifying objects with a common label - even if it's one that children have never encountered before - is a powerful cue to word meaning for both nouns and adjectives. Even at a very early age, children recognize that the morphosyntactic frame in which this novel label appears (e.g., *These are blickish* vs. *These are blickets*) has consequences for meaning

(Waxman & Booth, 2001), and use this information to determine whether the word picks out a property or an object. Children seem to be aware very early on that an adjective - particularly a prenominal one - cues contrast between object *properties* (Gelman & Markman, 1985), and nouns cue contrast between object category. Four-year-olds who are shown a novel object and told, *this is a BLUE one* are more likely to select a novel object with the same colour than if first told, *this is a BLUE* (Hall & Moore, 1997).

At the same time, noun labels themselves play an important role in adjective learning. When experimenters present adjective labels for properties alongside multiple objects from a category, and augment this word-exemplar pairing with a lexically rich noun label for these objects. e.g., *this is a stoof horsie*, children are more successful at mapping the adjectives to the properties they denote than when they hear a vague or uninformative noun, e.g., *this is a stoof {one/thing}* (Mintz & Gleitman, 2002).

Adjective position relative to the noun it modifies also matters. Children are more likely to select an object with the same property from a set when asked to find one that is *fep* if they are first shown another object and told, *this is a fep blicket* than if they are told, *this blicket is fep* (Prasada, 1992). Diesendruck et al. (2006) showed children a dog and told them either *this is a very DAXY dog* (prenominal position) or *this dog is very DAXY* (predicative position). They later introduced another dog as a comparison and said, *I want a very BLICKY dog* or *I want a dog that is very BLICKY*. Children were more likely to select the new, unlabelled dog when given the prenominal-prenominal prompts.

Children also use their knowledge of nouns and their familiarity with object properties in the world to make predictions about what a speaker is referring to. Three-year-olds rapidly look at an intended object upon hearing a prenominal adjective, even before hearing the noun. For example, when shown a red and a blue car, they successfully look at the correct car while hearing the colour adjective (Fernald et al., 2010) or a size adjective when given time to do so

(Davies et al., 2021). Three-year-olds presented with images of two different objects (e.g., a pillow and a book) look to the pillow on hearing the prenominal adjective *soft*, but wait until hearing the noun when they instead hear the relatively uninformative adjective *new* (Tribushinina & Mak, 2016).

Together, the research summarised above shows that young children skillfully exploit aspects of adjectives and the linguistic and discourse environments in which they occur to deduce and refine the meanings of adjectives. Children dynamically adapt their expectations of what qualifies as big, high, or strong depending on prototypical patterns as well as on other items in the context. They use adjectives to hone in on object properties and extend them to new categories. They use contrasting objects to cement the meaning of new adjectives, and recruit information from the meaning and the position of nouns to further embed adjective understanding.

3. Current approaches to adjective learning in the classroom

Having provided an overview of some of the main findings from lab-based research on young children's adjective acquisition, we now turn to classroom-based practice. Drawing from the classroom practice of our author team, here we present a baseline for our proposals on how psychological research (section 2) can inform new approaches to the teaching of adjectives across the curriculum (section 4). As teacher-educators and researchers based in the UK and the US, we outline broad approaches to engaging children with adjectives, then provide an example of how adjectives are currently taught in language and literacy in early elementary years and KS1. These approaches are also applicable in international literacy classrooms where English is the medium of instruction.

One of the core principles of vocabulary teaching is to enrich language input. Adjectives are excellent candidates for widening and deepening language experience.

SUPPORTING ADJECTIVE LEARNING BY 5-7 YEAR-OLDS

286 Children hear and use fewer adjectives in spoken language than nouns and verbs, particularly
287 in early language development (Blackwell, 2005). Pedagogical research underscores this; 3-
288 and 4-year-olds' spoken language (particularly in storytelling) contains less evaluative,
289 descriptive language than that of 5-year-olds (Nicolopoulou et al., 2021). In addition,
290 children's language experiences vary according to a variety of social factors, depending on
291 the amount and type of talk at home. Thus, children start school with considerable differences
292 in the range and number of adjectives they have encountered.

293 To maximise exposure and scaffold learning, teachers should provide opportunities
294 for children to engage with new descriptive vocabulary – specifically adjectives - in a range
295 of curriculum contexts. For young children, activities that develop spoken language are
296 fundamental to exploring and consolidating concepts. For example, when comparing a set of
297 moving toy vehicles on different surfaces, children can use adjectives to reason scientifically,
298 e.g., 'that car is faster because the surface is smoother'. Here, spoken language is a tool for
299 conceptual development. Other broader approaches to supporting descriptive language
300 development across the curriculum can be employed, e.g., DIALOGIC TEACHING, in which
301 sustained reasoning through talk is promoted in the classroom (Alexander, 2004), and
302 EXPLORATORY TALK, in which children are encouraged to reason, question, and discuss in
303 focused ways (Mercer, 1995). Adjectives can straightforwardly be applied to vocabulary
304 enrichment, conceptual development, dialogic teaching, and exploratory talk.

305 Explicit grammar teaching is most effective when taught in the context of real
306 language use, rather than via decontextualised exercises (Cushing & Helks, 2021; Jones et al.,
307 2013). 'Real' language is that which is familiar to children in their own spoken language
308 practices, arising from their own language or from examples they are likely to encounter in
309 everyday life, e.g., in children's books. The development of a 'grammar as choice' pedagogy
310 (Myhill, 2021) emphasises that language use should be based on purposeful, appropriate

choices made by a writer (rather than to fulfil a checklist of criteria) and that children's writing should be for authentic purposes.

Teaching grammar in context, and following a discrete planning and learning sequence underpins lessons targeting specific grammatical features (Bearne & Reedy, 2017). Here we illustrate this progression within a lesson focusing on adjectives, in which children identify examples of adjectives from a selected text. The adjectives are investigated in worked models through the three explicit teaching phases suggested by Bearne and Reedy (2017). The first phase involves the explicit teaching of the feature; in the second, children identify the language feature in texts; and in the third, children use the language feature and include it in their own writing, e.g., by experimenting for a given effect or by sharing examples with peers.

In the first phase of the lesson, the teacher introduces the children to the grammatical terminology and explains what the word class is used for, giving examples, e.g., 'Today we will be learning about adjectives, which are words that help us to give more information about a noun'. In the second phase, the teacher may use a picture book (for example, *Naughty Bus* (Oke & Oke, 2005; cited by Cremin, 2015)), to help the child to identify adjectives and to explore their role and purpose in the story. Through reading and investigation, explicit teaching, discussion, and experimentation, the teacher leads the children to choose appropriate adjectives to describe the object (here, the bus), and possibly justify their choice. The teacher may also introduce morphology by adding suffixes to root adjectives, such as *fast/faster/fastest*. The teacher also highlights the effect adjectives have on the story, such as adding detail, comparing, or making a description amusing. Children can then be encouraged to use adjectives in their own writing. This structured approach supports children in becoming confident users of language.

The teaching of specific language features such as adjectives is included in the programme of study (England) and Common Core (US) requirements for English, so is typically part of English or literacy lessons. As we have illustrated, it takes a structured form and progression. Although guidelines state the importance of developing language across the curriculum, it is only in English that statutory requirements are provided for the teaching of grammar. Adjectives are also commonly part of lessons about creative or imaginative writing. However, opportunities for developing children's knowledge, understanding and use of this important word class are often neglected in other parts of the curriculum, despite the fact that children are called upon to use and develop language in and through *all* areas of the curriculum. Thus, in the next section, we consider opportunities for promoting adjective understanding and incorporating adjectives in subject areas beyond English.

4. Applying research findings to enhance current teaching approaches

In section 2, we summarised research findings showing how young children develop adjectives. Here, we apply those observations to the school curriculum, focusing on classroom activities to illustrate the pedagogical potential for teaching new adjectives in areas outside of language and literacy. In doing so, we harness the major takeaways from section 2: (a) that some adjectives are best learned when they and the properties they describe are situated in context, (b) that word learning benefits from comparison and contrast of properties across multiple exemplars within and across kinds, and (c) that rich, informative nouns and noun frames support adjective learning.

As noted in section 3, the direct teaching of language features has typically been positioned within the teaching of English, and the skills associated with literacy. Here, we

turn our attention to curriculum areas¹ not typically associated with the specific teaching of language (Science, Math(s), Geography, History, and Art and Design), but which offer a range of opportunities for teachers to support children learning adjectives and using evaluative language. In turn, we show how knowledge of adjectives can support the acquisition and expression of concepts in these very areas. For each subject area, we begin by highlighting curriculum recommendations on adjective use in both English and US guidelines² (the contexts with which our international team of coauthors are familiar), then provide practical suggestions for practitioners, grounded in cutting-edge, developmental research that will enhance current teaching approaches and support learning. We conclude each subsection by recommending explicit, concrete steps teachers can take, and include recommendations for books to support adjective learning and use, again focusing on English. We invite readers to identify similar resources for young children in other languages.

4.1 Science.

Both the English and US curricula emphasise the importance of scientific literacy in children's education. This requires, among other things, to be able to adequately use technical terms and to describe and explain events and phenomena. The quality and variety of language that children hear and speak helps to develop their scientific vocabulary. In studying and articulating scientific processes and concepts, children encounter new vocabulary which they

¹ The National Curriculum for England (DfE, 2014) contains programmes of study for each curriculum subject area from Key Stage 1 (age 5-7) through to Key Stage 4 (age 14-16). For each year group, it provides details of the knowledge and skills that should be taught, along with non-statutory guidance in how to do so. Examples are taken from the programmes of study for the national curriculum for Key Stage 1. The curriculum for early childhood education in the US is determined at the state and local levels, but carefully shaped by standards coming from the Common Core for Math and Language Arts, the National Council for the Social Studies, the National Science Education Standards from the National Academy of Sciences, and the National Core Arts Standards, along with support from the National Association for the Education of Young Children. We acknowledge that other nations in the United Kingdom follow different national curricula, and that other curricula are used in English speaking countries around the world. We base our work on the two contexts in which we have expertise, while suggesting that the examples and resources provided are applicable to a wider range of contexts.

² We focus here on kindergarten.

SUPPORTING ADJECTIVE LEARNING BY 5-7 YEAR-OLDS

must integrate with existing foundational linguistic knowledge about science and scientific processes, and with concepts and ideas with which they are already familiar. Published standards emphasise the importance of oral and written discourse in promoting metalinguistic knowledge and in making further connections with scientific ideas (see Figure 6). This highlights the interactive role of communication skills and scientific ability.

In the Programme of Study for Science at KS1, children study plants and animals, properties of materials, the seasons, and weather. Terms such as *identify*, *describe* and *compare* are used to direct teachers in their design of teaching and learning. Similar topics and activities can be found on the National Science Education Standards (NRC, 1996) with lessons in Science involving the study of objects, organisms, and their environment. As children engage with the material, they must carefully observe properties of individual and multiple objects and phenomena, rely heavily on the use of specific adjectives to identify similarities and differences amongst them, and form categories based on these properties - all processes that not only invoke adjectives, but support learning new ones.

As children explore, discuss, and ask and answer questions about objects they encounter every day, they are highlighting object properties and describing them using adjectives. When children build on conceptual and linguistic knowledge they already have about familiar objects and their labels, they can then make comparisons and predictions based on this knowledge. In this way, it is the adjective describing the property of a familiar object that is foregrounded, rather than a new object being described.

Figure 6. Examples of objectives and standards that require adjective knowledge in science.

What can teachers do to support adjective use and learning in Science?

- a. When identifying and classifying common plants, ask children to sort plants into groups based on shared characteristics (e.g., leaf shape) or contrasting features (texture of the stem, absence/presence and colour of flowers).
- b. Use objects with which children are already familiar and for which they have names, and introduce new words for their properties. Recruit contrast and similarity to support learning new adjectives (e.g., *'Look at these bottles! This one is opaque, but this one is not. It's transparent. There are two more bottles. Please give me the opaque one'*)

SUPPORTING ADJECTIVE LEARNING BY 5-7 YEAR-OLDS

- c. Use noun labels and adjective position to introduce terms and highlight contrast among properties (e.g., *'This bottle is opaque. Look, there are more bottles over there. Please get me the opaque one'*).
- d. Focus on one kind of object at first (e.g., bottles), then later move to a wider set of objects that may share that property, but differ in others (e.g., a plastic bottle, a pair of sunglasses, an ice cube).
- e. Encourage children to give explanations for their method of sorting into categories, using adjectives to justify their choices (e.g., *'This is a smooth/shiny one and this is a spiky/dull one'*, *'This has big/long leaves and this has small/round leaves'*, *'All of these are rough but these are not'*).
- f. Guide children in making predictions about new members of a category (e.g., *'What do we know about these? So how do you think a new member of this group will probably look/feel/sound?'*)
- g. Use hand gestures along with the property labels to emphasise the features of the objects being described (e.g., *'These clouds are fluffy [mimic with hands], but these are not'*, *'These legs are long and bent'* [replicate with hands]).

For shared reading that can support the acquisition of novel vocabulary for science, see Figure 11.

4.2 Maths.

As part of the national curriculum of England, pupils should strengthen their conceptual understanding of mathematical concepts, and know how to deploy them quickly and for the purpose of solving problems across disciplines and in everyday life. The importance of spoken language is underscored as an essential aspect of children's cognitive, social, and linguistic development across the curriculum. Child-directed speech and speech elicited from

children in the context of maths is highlighted as supporting reasoning and critical thinking, and facilitating the acquisition of specific vocabulary (see Figure 7). Similarly, the Common Core State Standards (NGACBP & CCSSO, 2010b) state the importance of math for the development of skills required to solve everyday life problems. In early years of schooling this can be as simple as being able to use basic mathematical concepts to describe a situation (see Figure 7).

440

441 *Figure 7. Examples of objectives and standards that require adjective knowledge in math(s).*

442

443 *What can teachers do to support adjective use and learning in Maths?*

SUPPORTING ADJECTIVE LEARNING BY 5-7 YEAR-OLDS

- a. Present children with a set of numbers, fractions, or events, and ask them to order them numerically or group them by mathematical properties (e.g., primes, evens/odds, multiples of 3).
- b. Invite children to make comparisons between different numbers or outcomes of mathematical operations.
- c. Use familiar concepts and word labels in word problems, so that new vocabulary and processes can build upon an existing knowledge base.

For shared reading to support understanding and use of comparative adjectives in mathematics, see Figure 11.

4.3 Geography.

As children study the geography of their school and their immediate environment, and identify characteristics the physical environment in their community, their country, and the world, they must appeal to a variety of adjectives in contextualising locations, describing processes, comparing and contrasting human and geographical features, and outlining spatial and temporal variation. They are taught to communicate about data gathered through fieldwork, use spoken and written language to interpret and communicate geographical information, and appeal to vocabulary to describe physical features of land such as cliffs, vegetation, and weather, and human features of locations such as towns, farms, and villages. Familiar and novel adjectives are crucial when making observations and performing comparisons (see Figure 8). These include adjectives that describe dimensions of size, position/location, distance, shape, age, or time.

Figure 8. Examples of objectives and standards that require adjective knowledge in geography.

What can teachers do to support adjective use and learning in Geography?

- a. Build on children’s own language using familiar nouns and adjectives in making comparisons to reinforce understanding of the concept and scaffold the use of new adjectives (e.g., *mountainous*, *coastal*) (e.g., ‘*The shady part of the playground is the furthest away from the classroom*’, *The south-side of the school is sunnier than the north-side*’, ‘*The oldest part of the school building is bigger than the newer part*; ‘*The school garden has rectangular flower beds*’, ‘*This region is flat, but that one is mountainous*’).

SUPPORTING ADJECTIVE LEARNING BY 5-7 YEAR-OLDS

- b. Ask children to make cross-situational comparisons of dimensions of physical space and relations between objects (e.g., *'Which building/country is higher/longer/further away?'*, *'Which part of the playground is furthest away from our classroom/ nearest to the school gate?'*)
- c. Select two countries, cities, or farms, and ask children to use adjectives to identify similarities and differences between them based on multiple dimensions.
- d. Invite children to identify the country, sea, or town being described out of a set of possible candidates using adjectival terminology.

For shared reading that can support the acquisition of novel vocabulary for geography, see Figure 11.

4.4 History and Social Studies.

Both the English and US curricula emphasise an awareness of the past (leaders, historical events, aspects of life), the chronology of events, and historical concepts such as continuity and change, cause and consequence, and comparison. Teachers are encouraged to help children understand the methods of historical enquiry, enable them to ask questions and weigh evidence, and gain perspective by placing their knowledge in different contexts. Teachers invite children to learn about past civilizations and societies by writing or talking in descriptive ways about the similarities and differences between past and present (see Figure 9). Understanding the past and the lives of people in the past can be conceptually difficult for young children, and is most effective when linked to children's existing knowledge and experience. For this reason, aspects of everyday life, such as schooling, toys and local history, and significant national or local events are common topics at KS1. In US Social Studies, topics focus on communities, social interactions, and cultural differences, making history relevant to daily life.

Figure 9. Examples of objectives and standards that require adjective knowledge in history/ social studies.

What can teachers do to support adjective use and learning in History?

- a. Use a particular period of time as a contextual standard against which others are situated and can be ordered relative to each other using adjectives (‘*That was earlier/later/sooner*’).
- b. When writing or talking about aspects of the past, encourage children to identify differences among properties of objects by using adjectives of colour, size or texture, e.g., describe dolls from the Victorian period as smaller than today, wooden, and with painted clothing.

- c. Identify different kinds of tools from a previous period of time using familiar labels (e.g., spears, shovels), and invite children to notice and describe similarities (e.g., wooden, round, curved, metal).
- d. Highlight the connection between the shape of a tool and its function and purpose for people during a chronological period (e.g., *'The sharp edge allowed them to dig deeper holes when building structures'*).

For shared reading that can support understanding of life in the past as well as novel vocabulary associated with it, see Figure 11.

4.5 The Arts.

Across both the English and US curricula, children are taught to use a range of materials in visual arts to design and make products, and to draw, paint, and sculpt to develop and share their ideas. They develop various techniques using colour, pattern, texture, line, shape, form, and space. As they learn about a range of artists, craft makers, and designers, they are encouraged to describe the similarities and differences in practices and disciplines, and their own work. Children are encouraged to explore and use a variety of materials and tools and to describe artistic work using adequate language. All of these activities invite adjectival descriptions about how to successfully execute techniques, compare and contrast art forms, techniques, individuals, and styles with each other (see Figure 10). Similarly, instruction in music requires children to describe melodies, compare musical pieces, and express their own impressions and preferences—all of which involve the use of descriptive language (see Figure 10).

Figure 10. Examples of objectives and standards that require adjective knowledge in arts.

What can teachers do to support adjective use and learning in Art and Design?

- a. Invite children to describe the specific effects of changes in lighting, line, space, or form within the context of a particular drawing or painting.
- b. Identify multiple paintings from a particular artist, and invite comparisons among them using adjectives, then ask children to use these descriptions to decide whether a new work was made by the same artist.
- c. Select two instances of a particular design, asking children to compare and contrast the properties, supporting the adjective labels with gestures.
- d. Introduce a work of art or a craft with salient properties (e.g., shape, colour, size, pattern) by describing it with a prenominal adjective (e.g., 'This is a round/blue x')

SUPPORTING ADJECTIVE LEARNING BY 5-7 YEAR-OLDS

and saying that it is a special instance of its kind, then introduce new examples of that art or craft, teasing apart the properties represented in the first one, and ask them what the art or craft typically looks like.

For shared reading that can support the acquisition of novel vocabulary for arts, see Figure 11.

Figure 11. Recommended books to support adjective learning across subjects.

5. Summary and recommendations

By highlighting the importance of adjectives across the curriculum, we have made the case for expanding them beyond the language and literacy classroom and adopting a synoptic approach. To enable this, we have provided a primer for teachers on how young children develop adjectives, and then made a range of suggestions on how developmental

psycholinguistic processes can be adopted to enhance current teaching practices across children's holistic classroom experience.

For example, a robust finding from lab-based research is that some adjectives are best learned when they and the properties they describe are situated in context, i.e., alongside a collection of objects or events that all show the relevant property. In history lessons, we propose that a specific era could be used as a contextual standard against which others are situated and can be ordered relative to each other using adjectives of time. A second core finding is that children's word learning benefits from comparison and contrast of properties across multiple exemplars within and across categories. We have provided many ideas as to how this can be mobilised, for example in science, identifying objects that do and don't show a particular property within a taxonomy, e.g., *deciduous/ evergreen*.

Although we have drawn on our combined psychological and pedagogical expertise to provide these theoretically and empirically informed suggestions, many of our proposals are yet to be trialled and evaluated in a research study. Translational research will be necessary to ascertain whether our lab-inspired suggestions will be effective, feasible and acceptable in the classroom. We encourage practitioners to join us in these efforts and to share their results in open fora.

More broadly, we encourage researchers to build interdisciplinary and intersectoral collaborations with practitioners. We encountered challenges in cultivating and maintaining our partnerships, most notably the limited availability of the professional community during the pandemic and its aftermath, but found success through working with teacher trainers and offering continuous professional development with appropriate funding for teachers' cover. The rewards are long-lasting: we continue to work with practitioners in identifying dynamic research priorities, user-testing classroom approaches, and developing the next generation of researchers to engage widely to maximise the impact of their discoveries.

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