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Emergent literacy: Building a foundation for learning to read

The neural and behavioral foundations for learning to read are put into place well before formal schooling. Development of emergent literacy is a key concern for education stakeholders.

Series:
IBRO/IBE-UNESCO Science of Learning Briefings

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Theme/s:

Early childhood development / Effective teaching / Learning to read

This report arises from Science of Learning Fellowships funded by the International Brain Research Organization (IBRO) in partnership with the International Bureau of Education (IBE) of the United Nations Educational, Scientific and Cultural Organization (UNESCO). The IBRO/IBE-UNESCO Science of Learning Fellowship aims to support and translate key neuroscience research on learning and the brain to educators, policy makers, and governments.

Executive Summary

- The neural and behavioral foundations for learning to read are put into place well before the start of formal schooling
- In alphabetic languages, emergent literacy – the skills, knowledge, and attitudes that are developmental precursors to learning to read – involves many components, including:
  - Oral language; neural networks for language processing begin to develop prenatally
  - Phonological awareness (sensitivity to the sound structure of spoken language); infants have amazing speech sound discrimination abilities that adults do not
  - Print awareness; early exposure to environmental print is important
  - Letter knowledge; neural visual processing systems must be modified as children learn letters
  - Interactive book reading; an important prereading experience in its own right that involves many other components of emergent literacy
- Early childhood care and education is a key concern for education stakeholders in terms of emergent literacy

Introduction

Learning to read begins before birth. No, babies cannot learn to read[1], but the neural and behavioral foundations for later reading are put into place – or not – well before formal instruction in primary school begins. One of the key insights from the science of learning is that students build on prior knowledge[e.g., 2,3]. If they do not have a foundation to build on, beginning readers struggle to learn to read once they start school[4]. That can have lifelong consequences[e.g.,] [5].

Emergent literacy is a term used to describe the foundation for learning to read. It is "the skills, knowledge, and attitudes that are developmental precursors to reading and writing"[6, p. 848]. Emergent literacy involves many components[e.g., 6,7,8] that develop before formal schooling and work together to support later reading development in school[9-11]. This brief reviews some of the components of emergent literacy in alphabetic languages (that is, languages that use an alphabet in writing).

Oral language

Language learning is both based in biology and social[e.g., 12,13]. From infancy, babies establish social connections with responsive caregivers that involve back-and-forth interactions which support learning. This *serve and return* pattern – baby does something, caregiver does something in response – develops early and can be observed across contexts.[1] This sort of interaction is the basis for spoken conversation and oral language learning. Although caregiver responsiveness is in part based in culture, social learning processes in language development are universal[14, p. 124].

[1] See, for example, https://developingchild.harvard.edu/science/key-concepts/serve-and-return/.

Indeed, in the early years, most of the words that a child knows come from their caregivers: By age 3, between 86 and 98% of a child's vocabulary are words in their caregivers' vocabulary[15]. It is important to talk with and around children to build their spoken word vocabulary and other oral language skills. Other skills include knowledge of how words are combined, called *syntax*, when to use what kind of language, called *pragmatics*, and narrative, or story, comprehension[16]. Later reading will depend on these early vocabulary and oral language skills.

The home is the "ideal place" for young children to develop language skills in interaction with adults and other children[17, p. 8]. Although there are vast cultural differences, simply talking about what you are doing as you complete chores can be important oral language input for your child. New words may be learned more easily within the context of a shared activity. For example, making fried eggs together could provide an opportunity to see, touch, and learn the words *yolk* and *spatula*[18, p. 36]. Recasting and expanding on what a child says are other ways to provide more language input. For example, a child's demand to "Read book!" can be recast to "Oh, do you want to read this book now?" and expanded to "I really like this interesting book about animals and where they live. Let's read it again together!"[18, p. 37].

In general, children from low-income families tend to be exposed to fewer words than children from middle- and high-income families[e.g., 15,19-21]. This is known as the *word gap*[e.g., 15,22]. The word gap is already evident at 18 months of age, when children from low-income families in the United States know, on average, 107 words, whereas children from high-income families know, on average, 174 words – more than 60% more[23]. This gap is still evident at 36 months and can widen through kindergarten entry at age 5, after which the gap is maintained[24].

Not just the quantity, but also the quality of early caregiver-child oral communication varies[e.g., 25]. For example, one study found that quality of parent-child interactions in low-income households when children were 24 months old accounted for more than one quarter of the variation in the children's spoken language one year later[26]. Parental use of diverse, sophisticated vocabulary and narrative language with preschoolers also influences later vocabulary ability, beyond quantity [27].[2] And when parents modify their speech for their young children in one-on-one situations (called *child-directed speech* or *parentese*, as compared to using standard speech in group interactions), it is positively related to both speech from the child at the time and later word production[29]. Both the quantity and quality of words that a child brings to formal schooling affect their reading readiness.

[2] Beyond parents, preschool teachers' use of sophisticated vocabulary during free play is related to word recognition and reading comprehension skills in fourth grade[28].

Remarkably, neural networks for oral language processing begin to develop prenatally. When pregnant women read aloud, both heart rate and motor activity react in 36-week fetuses[30]. In addition, neural recordings from newborns show that the brains of babies who were exposed to recordings of made-up words as fetuses respond to pitch changes in the made-up words when they are played after birth, whereas the brains of infants not exposed in utero do not register the pitch changes[31]. This is consistent with auditory learning beginning before birth and suggests that processing was already tuned to the speech feature (pitch change) heard prenatally[31].

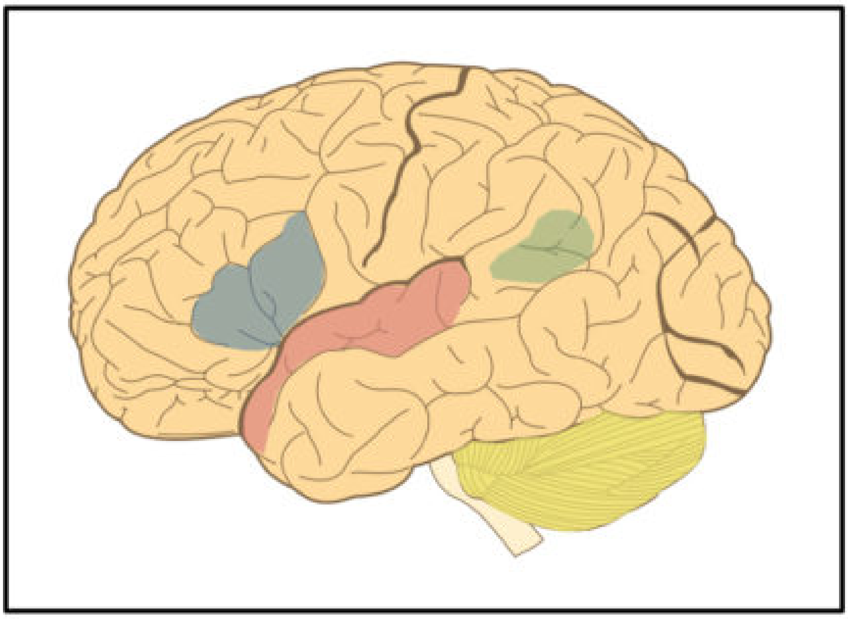

Figure 1. A left hemisphere view of the human brain with the superior temporal lobe (pink), angular gyrus (green), Broca's area/inferior frontal gyrus (blue), and cerebellum (yellow) regions shaded. Modified from Hugh Geiney (shading colors added) on Wikimedia Commons under CC-BY-SA

In newborns, left hemisphere temporal areas in the brain show more activation for speech than for silence or speech played backward, suggesting early left hemisphere specialization for speech sound processing[32]. At three months of age, infants listening to their home language show brain activation in the same regions as adults do: along the superior temporal lobe, in the angular gyrus, and in Broca's area[33,34]. These regions are highlighted in Figure 1. By 4 to 6 years of age, children who have experienced more conversational give-and-take with caregivers show greater activation in Broca's area/inferior frontal gyrus while listening to a story than children who have experienced less conversation with caregivers[35]. This links children's early language experiences in the home with differences in neural language processing[35]. Structurally, brain scans of 3- to 5-year-old preschoolers also show differences associated with vocabulary knowledge: higher vocabulary scores (spoken word knowledge) are related to more left-lateralized language networks[36]. These same networks will be used as children learn to read later[e.g., 37].

Phonological awareness

Oral language development is a precursor of reading development not only because of exposure to vocabulary, syntax, and pragmatics, but also because of exposure to the actual sounds of spoken language[e.g., 38]. Sensitivity to the sound structure of spoken language – including the abilities to detect, identify, and manipulate those sounds – is called *phonological awareness*[e.g., 39,40].

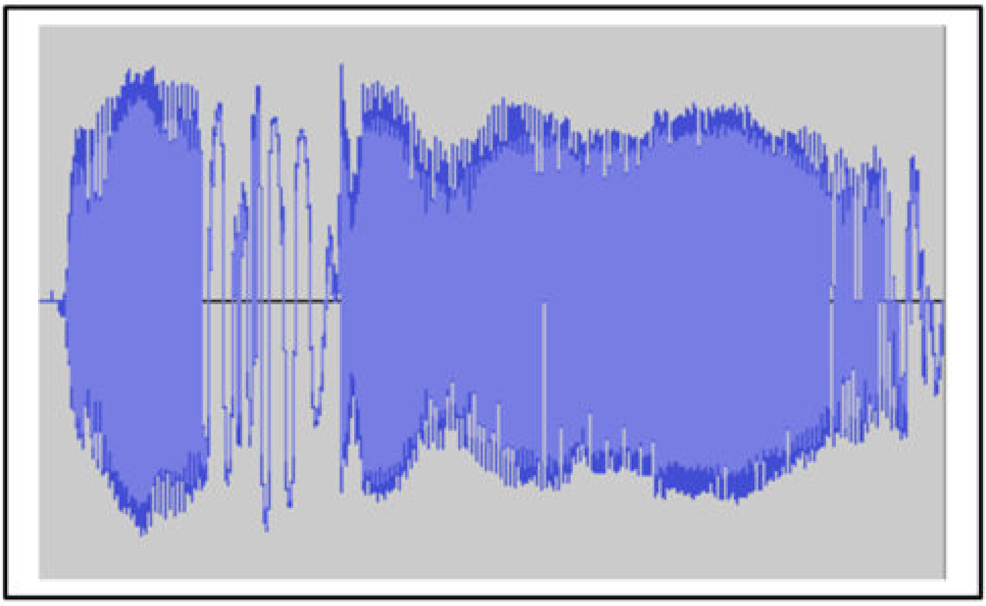

Figure 2. An audio recording, in spectrogram form, of a person saying, "What do you mean?" in English. Notice that there are no breaks between the words. Physically, speech is a continuous stream of sound.

As a physical thing, speech itself is actually a continuous stream of sound. If you were to ask, "What do you mean?" and record yourself saying that phrase aloud, the spectrogram of your recording would show a continuous stream with no breaks between the words, as in Figure 2. As a fluent speaker, your brain neatly parses or segments the speech stream into meaningful pieces because you have developed phonological awareness. (You might know from listening to someone speak in a foreign language that this parsing into words is not an easy task – where one word ends and another begins in the speech stream is not at all clear when listening to non-native speech.) This is something that children's brains need to learn to do before beginning to read.

In everyday native language processing, the meaningful pieces that we parse the speech stream into are words. However, we can also parse the speech stream into smaller units, like *onsets* and *rimes* or *phonemes*. Speech can be broken down into different parts in every language, although characteristics of each oral language may make it more easy or difficult to parse into different sound segments[39]. In general, children become aware of increasingly smaller segments within spoken language with age[39,41].

Preschoolers are often aware of the phonological units onset and rime in spoken word processing. The *onset* is the initial phonological unit of a word and the *rime* is what follows. For example, the onset of the spoken word *cat* is the *c* sound and the rime is the *at* sound. Similarly, the onset of the spoken word *chain* is the *ch* sound and the rime is the *ain* sound. You will recognize that the rime unit is what allows for words to rhyme. The rime is simply the ending sound of a word that can be rhymed (sound like) the ending sound of another word, such as the *c<u>at</u>* in the *h<u>at</u>* that *s<u>at</u>* on the *m<u>at</u>* in English. Typically, rhyme awareness begins to develop around 3 or 4 years of age[42]. Any spoken word activity that emphasizes the rime unit helps children to develop rhyme awareness. For example, nursery rhymes, rhyming games, poetry, and children's songs often highlight the rime unit[e.g.,] [43,44].

Rhyme awareness contributes, uniquely, to later reading ability[e.g., 45,46]. Children's rhyming ability at 3 and 4 years old is related to their reading abilities at age 6, perhaps because it helps students to form spelling categories when they shift from speech to print [47]. That is, *cat*, *hat*, *sat*, and *mat* not only sound similar but are also spelled similarly in English. Neural recordings during spoken word rhyming tasks indicate that the brains of pre-literate children do distinguish between rhyming and non-rhyming spoken word pairs, revealing a neural basis for sensitivity to the rime unit[e.g., 48,49]. In one study, the size of the neural rhyming effect in 3- to 5-year-olds was correlated with scores on a standardized test of phonological awareness[49], providing another connection between brain processing and behavior.

The smallest piece of spoken sound is called a *phoneme*. For example, in English, this would be the sound that the letter *p* makes or the sound that the letter *b* makes. The spoken word *cat* has three phonemes: the *c* sound, the *a* sound, and the *t* sound. Parsing the speech stream into phonemes is difficult for many reasons. One is that what fluent speakers might think of as the same sound actually sounds different depending on what other sounds are around it, an issue called *coarticulation*. For example, think of the sound that the letter *s* makes in English. Now, slowly speak the word *see* and then the word *so*. The *s* sound sounds a little bit different when it is followed by an *ee* sound or followed by an *o* sound. You can both hear this and feel it – notice the different shapes your lips and mouth make to say each *s* sound[50]. Children need to learn that all the slightly different versions of the *s* sound (called *allophones*) are the same sound. This is a difficult auditory *perceptual generalization* task that involves grouping individual instances (e.g., all the slightly different *s* sounds) into one category (e.g., *s* sound).

Surprisingly, infants are better at perceiving and discriminating isolated phonemes (that is, phonemes not part of a speech stream) than adults are. Infants can perceive phoneme contrasts (e.g., *bah* versus *pah* spoken in English) in both their native language and in non-native languages[e.g., 12,51]. This universal phoneme discrimination ability declines across the first year of life as infants gain greater exposure to the sounds of their native languages[e.g., 12,51]. And by their first birthdays, babies can only distinguish between phonemes in their native language(s), not in non-native languages, the same pattern seen in child and adult native speakers[e.g., 12,51]. **Figure 3** shows data from both cross-sectional (different infants at different ages) and longitudinal (the same infants at different ages) studies illustrating this pattern[51].

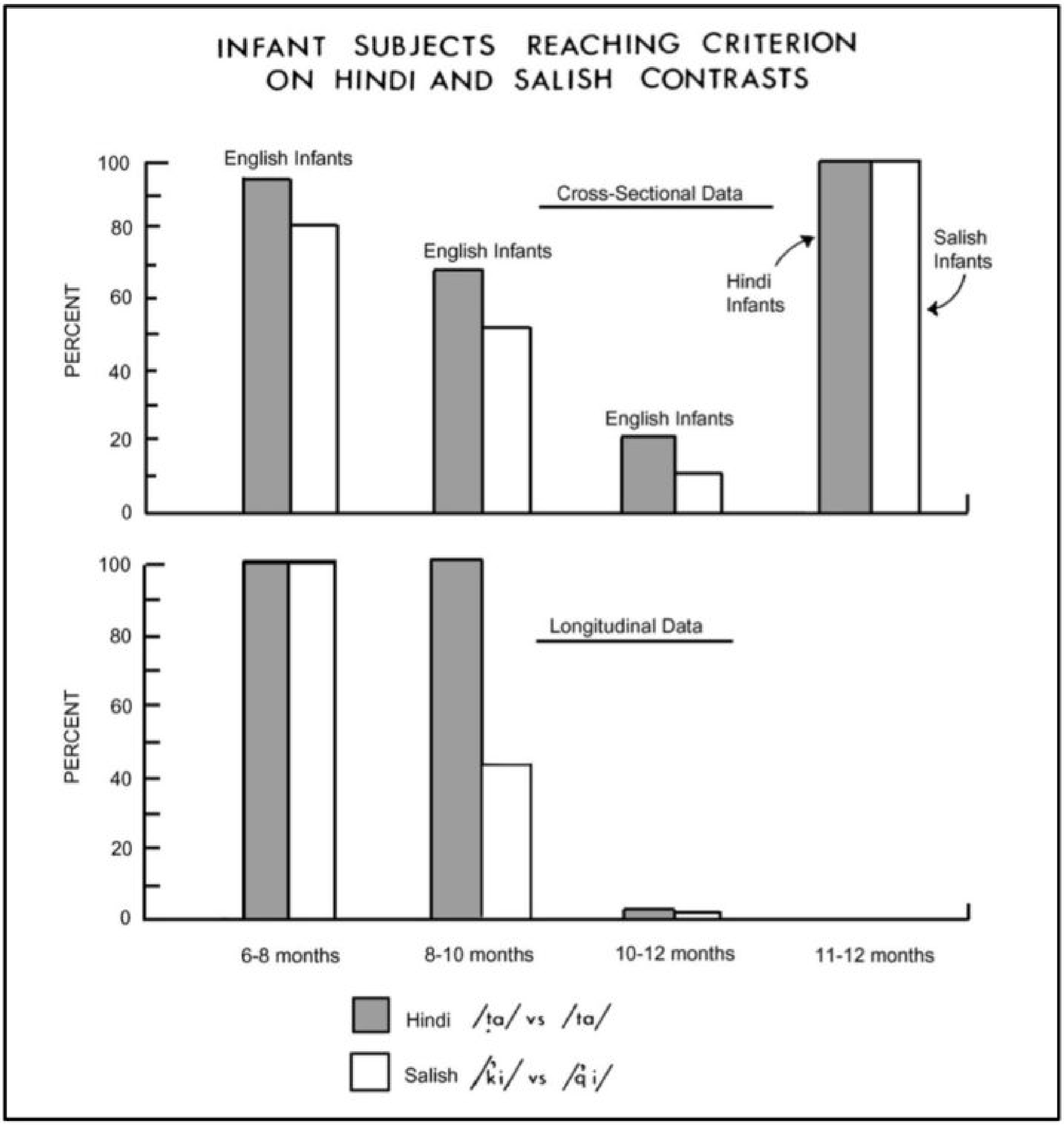

Figure 3. The proportion of infant research participants from three ages and various backgrounds reaching criterion on Hindi and Salish phoneme contrasts. At 6-8 months old, infants growing up in English-speaking households can distinguish the phonemes in the other languages. But by 10-12 months old, infants growing up in English-speaking households can no longer discriminate between phonemes in a non-native language. Reprinted from ref 51: Infant Behavior & Development, Vol. 25, J.F. Werker and R.C. Tees, Cross-language speech perception: evidence for perceptual reorganization during the first year of life, Figure 4, p. 131, 2002, with permission from Elsevier.
https://www.sciencedirect.com/journal/infant-behavior-and-development

Brain recordings show that native and non-native phonemes are processed similarly in the superior temporal region, Broca's area, and the cerebellum in 7-month-old infants[52] (refer to Figure 1 above). But in 11- and 12-month-old babies, native phonemes activate superior temporal areas more than non-native phonemes and non-native phonemes activate Broca's area and the cerebellum more than native phonemes, the pattern seen in adults[52]. This may be the neural processing underlying the behavioral shift from young infants being "citizens of the world" able to discriminate all isolated phonemes in any language (of the ones tested so far) to becoming specialized for auditory processing of only the sounds of one's native language by the end of the first year[52, p. 11238]. This has been interpreted as "experience-related neural commitment" in typical development in terms of well-established auditory memory traces for native phoneme processing by age 1[53, p. 738].

Curiously, although young infants can discriminate between phonemes in speech-perception tasks, they do not use the same phonemic information in word-learning tasks[54]. For example, at 14 months old, infants can distinguish between the spoken sounds *bih* and *dih* in their native language, but when those sounds are attached to objects in a word-learning task, the same infants fail to distinguish between the *bih* and *dih* object labels[54]! Brainwave recording studies have confirmed that similar-sounding words and made-up words (e.g., *bear* and *gare*) are processed similarly by 14-month-olds[55]. But, by 20 months of age, known words (*bear*) are processed differently than similar-sounding unknown words (*gare*)[55]. So, learning new words – vocabulary development – helps to organize neural systems involved in processing phonemic detail[55]. However, the ability to parse a spoken word into all of its constituent phonemes does not typically develop until children formally begin learning how to read (see the brief in this series *Building a brain that can read, part 1: sound and sight*)[e.g., 56].

Print awareness

Before children can begin to learn to read, they need to become aware of print. Print can be found in many places in the environment; for example, on signs, on cereal boxes, on the tag in your shirt, in logos, or on the letter that came in the mail[e.g., 57,58,59]. Identifying and talking about environmental print with children helps to develop their *print awareness*. As they become aware of print, young children learn that print has many functions. For instance, it can provide information, like a recipe, or solve a problem, like an instruction manual. Understanding the purposes of print can help motivate young children's interest in print. Caregivers can also create *print-rich environments* by increasing the amount of print available, for example, by adding printed labels to objects (e.g., a bin of crayons labeled *crayons*), having children in a group wear name tags, using a written daily schedule, making lists, or having children write notes to one another. Caregivers can "capitalize on children's natural attraction to environmental print" by using it to develop emergent literacy skills like print awareness[59, p. 231,60].

Children also need access to books to learn about how print works and what reading is. They need to play with books and read books with adults to learn that books are held right-side-up, that we start reading at the beginning with the front cover, and that English is read from left to right (or that Arabic is read from right to left), from the top of each page to the bottom, in order of the pages from first to last. Through experiences with books, children become aware of conventions like the white spaces that separate words and the things on a page that are not words (e.g., pictures and punctuation marks). They come to learn that the words on the page do not change over time – the story is always the same. Together, this knowledge is called *concepts about print*[61].

Letter knowledge

Letter knowledge, also called *alphabet knowledge*, involves being able to identify letters, knowing the names of letters, and knowing the sounds associated with printed letters[e.g., 62,63]. Many caregivers talk to their children about letters, differentiating them from pictures, by age 1 or 2[64]. But many young children learn the names of the letters from the alphabet song [3] and must learn to match the spoken letter names from the song with the printed visual letters[57,62]. In learning to recognize and name letters, the first letter of a child's name seems to be particularly salient and the other letters of the name may also be more familiar and better learned[e.g., 65,66-68]. However, practicing saying letter names and sounds and speeded recognition of letters leads to better letter knowledge than activities like just recognizing letters in printed names[69]. In curricula that use both letter names and letter sounds (some focus only on sounds), explicit alphabet instruction that pairs names and sounds is associated with significant growth in alphabet learning in prereaders[70].

[3] For example, https://www.youtube.com/watch?v=5xuZxGirWQI.

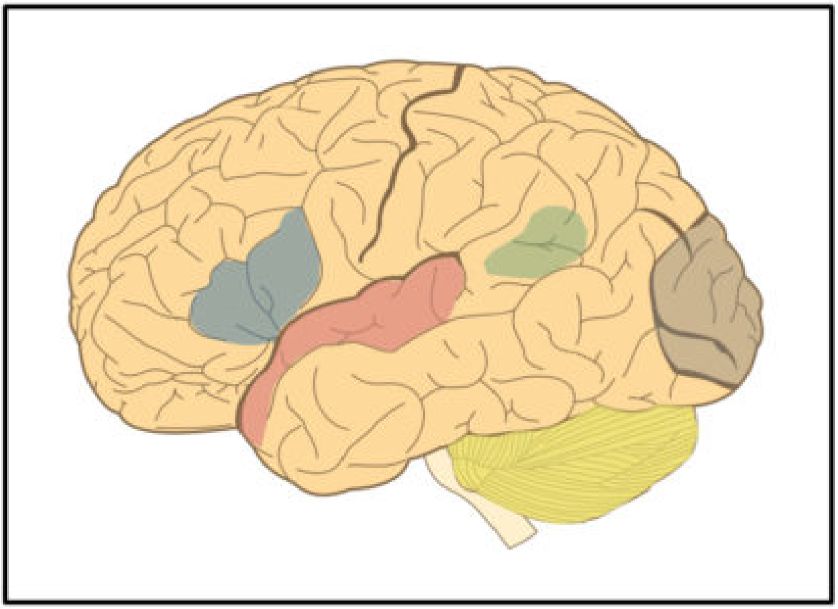

Figure 4. A left hemisphere view of the human brain with the superior temporal lobe (pink), angular gyrus (green), Broca's area/inferior frontal gyrus (blue), cerebellum (yellow), and visual cortex/occipital lobe (gray) regions shaded. Modified from Hugh Geiney (shading colors added) on Wikimedia Commons under CC-BY-SA

As visual objects, the letters of the Roman alphabet contain very little perceptual information: They are abstract, arbitrary, and can be highly confusable[e.g., 57,71-73]. For instance, it is only cultural convention that the same stick and ball in one configuration are a *b*, in another are a *d*, and in a third are a *p*. This makes learning to identify and discriminate the letters of the alphabet a challenging task.

Fundamentally, letter identification is a visual process involving feature detection[74]. For example, the feature of a small horizontal line is crucial for distinguishing G from C[e.g., 57]. Detecting visual features is important for both uppercase and lowercase letters, but children tend to learn uppercase letter names and sounds first [62,75]. They must also learn what is a letter and what is not a letter. The ability to distinguish symbols with similar features (for example, #) from letters in prereaders is related to reading ability in first grade[76]. Most of the basic perceptual processing of the visual features that make up letters occurs in the occipital lobe, in the visual cortex (see Figure 4). This area is specialized for processing visual information like the orientations of the lines, curves, angles, terminals, and junctions that characterize letters[e.g., 77]. In fluent readers, the detailed features of letters seem to be processed in parallel, very quickly (within about 150 milliseconds of presentation)[e.g., 78,79].

Figure 5. Learning that each of these is an A involves visual perceptual generalization and is part of letter or alphabet knowledge.

Just as phonological awareness involves auditory perceptual generalization in terms of allophones, letter knowledge involves visual perceptual generalization in terms of letter shapes. Children must learn that all of the varieties of, for example, printed

As are As, as in Figure 5[e.g., 57]. That is, letters are more than just visual objects – in context, they map onto abstract letter identities, like "A"[e.g., 79,80,81,82].

Also in terms of visual perceptual processing, children must learn that orientation matters for letters. For most objects in a child's life, a change in orientation does not change the identity of the object. For example, a teacup set right-side-up and the teacup set upside-down are both the same teacup. But, for letters, a right-side-up lowercase *b* and an upside-down lowercase *b* are not the same thing: one is a *b* and the other is a *p*. Similarly, a teacup flipped to the left or flipped to the right is still the teacup; we easily recognize the mirror image of an object as the object (this is called *mirror invariance*). But a lowercase *b* flipped to the left becomes something else: a lowercase *d*. As part of alphabet knowledge, children must learn that letters are a special case in which mirroring can create a new object. Indeed, learning to read involves a loss of mirror invariance processing[e.g., 83,84]. This is reflected in the brain's visual system, in a region called the *visual word form area* (see Figure 6A)[85-87]. The loss of mirror invariance begins to emerge in the preschool years with growing letter knowledge[88]. This may be related to the prevalence of mirror writing in prereading children as part of typical development[89,90] (see Figure 6B).

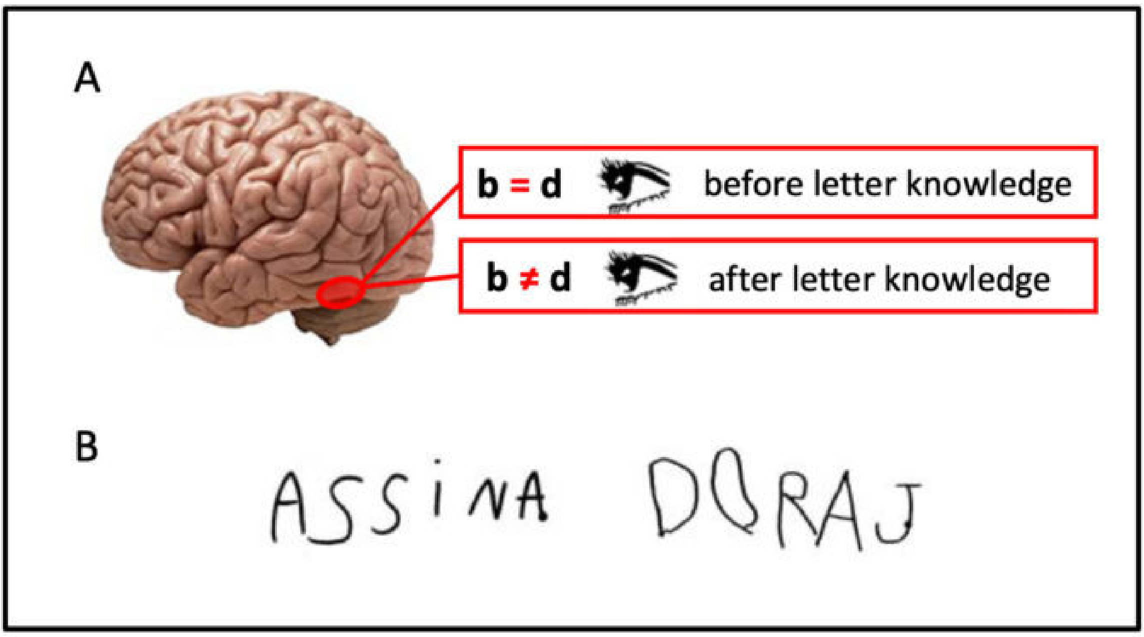

Figure 6. (A) A left hemisphere view of the visual word form area (indicated by the red oval). There is a loss of mirror invariance processing in this region with growing letter knowledge ("=" indicates "processed similarly to"). There is also increased activation for print processing in this region with growing letter-speech sound knowledge. (B) Examples of mirror writing in typical development from 5-year-olds Anissa and Jarod writing their names. [(A): Modified from Brain pathways for mirror discrimination learning during literacy acquisition in ref 86 by Pegado, F., Nakamura, K., and Hannagan, T., Fig. 1, p. 3, used under CC-BY. (B): Examples from Fig. 3, p. 200, in ref 89. APA permission not required for reuse of one figure from a journal article (https://www.apa.org/about/contact/copyright/).]

Along with the visual processing of letters, knowledge of the sounds associated with letters develops as part of emergent literacy. Amazingly, prereading children who have been trained on letter-speech sound correspondences (for example, *b* says *buh*) for only 3 to 4 hours show greater activation in the visual word form area region to printed words (as compared to printed strings of letter-like characters) after training than before [91]. This is the case even though the children cannot actually read the words. Other studies have reported similar neural effects of letter-sound training[e.g.,] [92]. High levels of adult interaction in such training may be particularly important[e.g., 93]. In another study with prereaders, the size of neural electrical responses recorded over the left visual word form area region was correlated with a behavioral measure of letter-sound knowledge, again confirming a brain-behavior relation in emergent literacy[94]. Overall, letter-sound knowledge may be a first step in specializing the brain for printed word processing in reading[91].

Shared book reading

As noted above, access to books is important for developing print awareness. However, the effects of book access go well beyond print awareness. In one study across 27 nations with over 70,000 cases, the authors concluded that

> [c]hildren growing up in homes with many books get 3 years more schooling than children from bookless homes, independent of their parents' education, occupation, and class. This is as great an advantage as having university educated rather than unschooled parents, and twice the advantage of having a professional rather than an unskilled father. It holds equally in rich nations and in poor; in the past and in the present; under Communism, capitalism, and Apartheid; and most strongly in China[95, p. 171].[4]

[4] If physical books are not available, for example, through local libraries or library extensions (e.g., bookmobile), the International Children's Digital Library (http://en.childrenslibrary.org) might be an option.

While recognizing diversity in family culture and linguistic background, reading aloud (or *shared book reading*) with infants, toddlers, and preschoolers is a valuable educational practice. Indeed, it is recommended by the American Academy of Pediatrics [96]. It can enhance social and emotional development, strengthen caregiver-child relationships, support cognitive development, build a knowledge base about the world, and develop emergent literacy skills[e.g., 10,57,97-100]. Reading aloud with preschoolers can also help to develop an interest in reading and motivation to read, which will further support learning to read during formal schooling[e.g., 101,102].

In terms of developing emergent literacy skills, shared book reading with young children is related to improved vocabulary, letter-name knowledge, language skills (like better story comprehension and understanding of more complex syntax), and listening skills[e.g., 97,98,103,104-113]. Focusing on vocabulary, reading aloud with children builds beyond everyday oral language interactions. Picture books contain more unique words than child-directed speech, so can be an important source of new vocabulary when read aloud[114]. And parents also tend to use more diverse vocabulary and more complex syntax during shared book reading, as compared to language used outside of book reading interactions[111]. Moreover, these vocabulary words used and learned during shared book reading are not just words; they represent a child's background knowledge, and are crucial for growing understanding.

Reading books with preschoolers helps develop emergent literacy skills especially when it involves *dialogic reading* techniques[e.g., 115,116]. Dialogic reading is a way to read interactively with a child. Rather than just reading aloud what is on the page, caregivers can discuss the book with children as they are reading together[e.g., 7,18]. For example, caregivers can initiate an exchange while reading, based on the pictures or text (e.g., ask "What is the dog doing?"), and then evaluate and expand on the child's response (e.g., if the child responds, "see girl," the caregiver can say, "Yes, he is looking at the little girl in the blue dress. And he is sniffing the white flower."). Caregivers can also ask open-ended questions (e.g., "What is happening on this page?), "wh" (who, what, where, when) questions (e.g., "What does *sniffing* mean?"), and questions that help the child connect the book to their lives (e.g., "Do you remember the dog we saw yesterday?" or "How do you think the dog felt when that happened?").

Caregivers can learn how to do dialogic reading with their young children[e.g., 115,116]. When given appropriate books and shown how to read interactively (for example, through programs like *Reach Out and Read,* run through pediatrician's offices and clinics, in which parent training lasts just a few minutes), parents do more shared book reading with their preschoolers and the children have better language skills[117-119]. Preschool teachers, who also may not use interactive reading techniques without training[e.g., 120], can also learn to read more interactively with their young students[e.g., 121,122,123]. Importantly, it has been shown that caregivers can be taught how to read interactively and dialogic reading of picture books can benefit emergent literacy skills in young children in both high-income and low-income countries, even with caregivers who are not themselves literate[124,125].

At the neural level, only a few studies have explored the functional brain correlates of early book reading. For example, using fMRI, researchers have reported that preschoolers with greater home reading exposure showed greater activation in left hemisphere regions involved with processing meaning while listening to stories[126] and that mother-daughter shared reading quality (interactivity) with 4-year-olds was correlated with activation in similar brain regions during story listening[127]. This suggests that foundational brain networks involved in processing mental imagery and story comprehension may be more developed in young children who have had more quality shared book reading experiences. These networks will be used later when children can read to themselves[e.g., 37].

Conclusion

The emergent literacy knowledge and skills that infants, toddlers, and young children build through experiences in their homes, daycares, and preschools is the foundation for formally learning to read in school. It determines how well children will learn to read, which in turn determines lifelong career and economic prospects[10, p. 54]. Rather than being "ready to read" at any given age, children are ready to read when they have developed the contributing skills and knowledge over time. As illustrated in Figure 7, children who begin school with these foundational skills tend to build on them towards success, whereas children who begin school without foundational skills tend to continue to falter[4]. This is known as the *Matthew effect* in reading: the rich get richer while the poor get poorer[4]. Access to resources is crucial to addressing the Matthew effect:

> The evidence base clearly demonstrates that in disadvantaged, low-resource communities, in which exposure to print and language is likely to be low, the focus on emergent literacy has an even greater impact on reducing disparities in reading performance and achieving favorable reading outcomes. That early learning opportunities reduce disparities created through socio-economic difference needs to be clearly recognized and incorporated into programming interventions, and additional resources made available for disadvantaged children with few resources in the home literacy environment[128, p. 13].

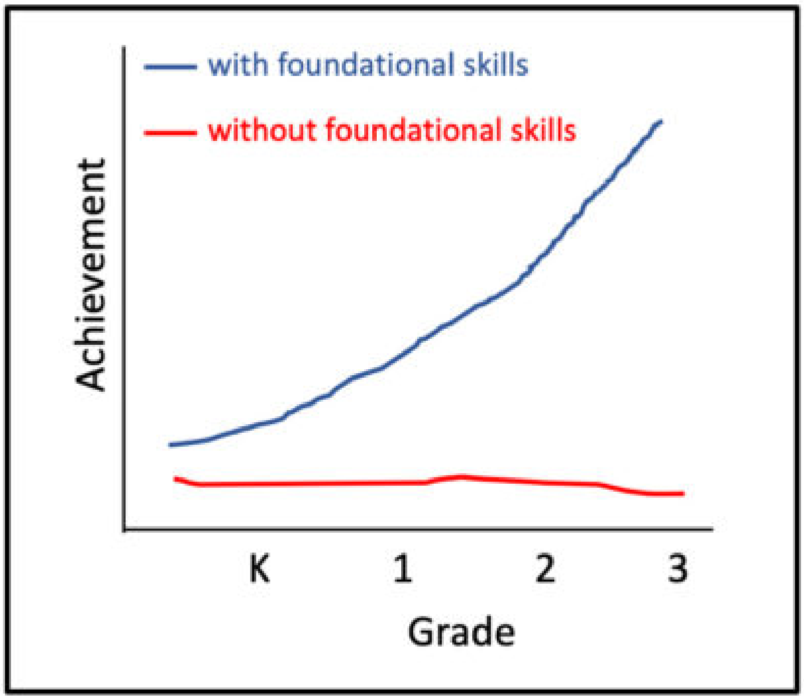

Figure 7. An illustration of Matthew effects in reading. Children who begin formal schooling with foundational (emergent literacy) skills tend to build on those skills and thrive, whereas children who begin formal schooling without foundational skills tend to continue to fall further

behind.

Thus, early childhood care and education – here, in the context of literacy – is "unambiguously a key concern for education stakeholders" as "a critical starting point in realizing equitable, quality education and lifelong learning"[129, p. 4].

A number of studies have shown that some preschool teachers lack knowledge about emergent literacy[e.g., 38,130-132]. Unfortunately, research on the effects of professional development is mixed. For example, one study in New Zealand found small positive effects[133], but another study in the United States found no effects[134]. In a review of literacy interventions in low- and middle-income countries specifically, there was a moderate effect (*d* = .4) of providing professional development and ongoing support on emergent literacy to teachers[135]. Further research is needed to learn how best to support early childhood educators in using evidence-based emergent literacy practices that affect student learning[136]. However, understanding the components of emergent literacy and how to facilitate their development, as reviewed in this brief and elsewhere[e.g., 7,18,113], is a beginning[e.g., 137,138,139].

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