

**Best Practices for Building Educator Capacity and Competency in Early  
Language and Literacy Development: Birth to Third-Grade**

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## **Abstract**

The following manuscript is a review of research surrounding best practices for language and literacy development in children birth to age three. Part 1 of the review begins with the research on language acquisition beginning in utero, continuing through infancy and onto the emergence of speech. The review discusses the importance of language interaction with others in the development of volubility or fluent speaking. To develop meaning, the importance of concrete referents, three-dimensional visualization, object permanence, and mental imaging are reviewed. The effects of socio-economic status, school, and language impairment are discussed in terms of their effect on child development. Reading development is addressed, including letter identification, phonological awareness, letter-sound correspondence, word reading, reading fluency, and comprehension. Part II of the reviews the research and implications for teaching language and early literacy skills. The review includes a review of recommendations for instruction by reading process and the strength of the scientific research compiled by What Works Clearinghouse. Part III discusses the efficacy of various professional learning models including micro-credentialing, literacy coaching, web-based delivery, and sustaining at-scale change.

## I. Early Development of Language and Literacy

### Language Acquisition

Researchers have demonstrated that language experiences in utero during the third trimester can result in recognition of the mother's voice and post-natal phonetic preferences (DeCasper, Lecanuet, Busnel, Granier-Deferre, & Maugeais, 1994; Winkler et al., 2003; Kisilevsky et al., 2003; Moon, Lagercrantz, & Kuhl, 2013). Just three to four days after birth infants prefer their native prosodic pattern over those that are less familiar (Christopher, Mehler, & Sebastian-Galles, 2001; Mehler, et al., 1988). Upon birth the newborn hears what presents as streams of speech from caregivers in its immediate area. How to partition this continuous speech stream into individual words, what's called the speech segmentation problem, is the infant's first language challenge (Cole & Jakimik, 1980; Roy & Pentland, 2002). For infants living in an English-language environment the first breakthrough occurs with the discovery that 90% of the time words are stressed on the initial syllable (Cutler & Carter, 1987; Thiessen & Saffran, 2003). Given this discovery the infant soon develops a preference for words with a strong/weak stress (called trochees) as opposed to iambs which are words with a weak/strong stress (Jusczyk, Cutler, & Redanz, 1993). Between the age of five and nine months the baby learns to use this lexical stress to discriminate between strong and weakly stressed syllables (Weber, Hahne, Friedrich, & Friederici, 2004). By applying what is known as statistical learning (when given one event a second is likely to occur) the child uses their awareness of lexical stress to eventually identify word boundaries and gain critical access to individual words (Aslin, Woodward, LaMendola, & Bever, 1996; Brent & Cartwright, 1996; Cairns, Shillcock, Chater, & Levy, 1997; Christiansen, Allen, & Seidenberg, 1998; Spencer, Kaschak, Jones, & Lonigan, 2015). Also during this period the child comes to understand that specific words can be distinguish based on the probability that many syllables co-occur (Aslin, Saffran, & Newport, 1998; Jusczyk & Aslin, 1995). Again using conditional probability learning the child begins to anticipate words within sentences (Conway, Baurnschmidt, Huang, & Pisoni, 2010). Emerging sensitivity to lexical stress eventually matures to become a prosodic template onto which the child will fit their own speech (Vihman & Vellman, 2000). At about nine months the child's knowledge of the prosodic properties of their respective language is hypothesized to be important to fluent speech and communication (Church, 1987; Cutler & Butterfield, 1992). What were once word streams are now prosodic phrases that facilitate faster encoding of language into memory (Mandel, Jusczyk, & Nelson, 1994; Mandel, Jusczyk, & Pisoni, 1995). This same process will eventually aid the reading of text.

### Speech emergence.

Infants exhibiting normal development progress through identifiable speech stages (Oller & Eihlers, 1988). From birth through two months infants are in the *phonation* stage and produce comfort sounds with normal speech-like phonations. Around two to three months the child enters the *cooing* stage when articulated sounds are produced in the back of the vocal cavity. Cooing is followed by *marginal babbling* that is composed of simple lip movements. While these sounds are precursors to consonants they are not yet well-formed. It is during the *expansion stage* (4 to 6 months) where a variety of new sounds emerge including raspberries, squeals, growls, yells, and

whispers, as well as some vowel-like sounds. At this point mature syllables are still underdeveloped. It is in the *canonical* stage at 7 to 10 months when the child produces mature, phonetic sequences that are the building blocks of words (e.g., mamama, dadada, bababa). As infants move through these speech stages their interactions with others influences their speech development in profound ways.

Volubility refers to the duration of talk engaged in over a period of time by the child with research showing a positive effect for SES (Oller et al., 1994). As infant volubility increases so does parental response to the child (Gilkerson & Richards, 2009; Goldstein, King, & West, 2003; Gros-Louis et al., 2006; Keller, Lohaus, Volker, Cappenberg, & Chasiotis, 1999; Warlaumont et al., 2010). Infant-parent speech interactions are important as numerous authors have connected them to emotional and intellectual development in the infant (Anderson, Vietze, & Doeckki, 1977; Bakeman & Adamson, 1984; Beebe, Jaffe, Feldstein, Mays, & Alson, 1985; Bornstein & Tamis-LeMonda, 1989; Cohn & Tronick, 1987; Hsu & Fogel, 2003; Jaffe, Beebe, Feldstein, Crown, & Jasnow, 2001; Papoušek & Papoušek, 1979; Stern, 1974; Tronick, 1982; Weinberg & Tronick, 1996). During the expansion stage the infant's attempts at pronouncing syllables containing well-formed consonants and vowels become more clearly and reliably articulated, a phenomenon referred to as *canonical babbling* (Koopsman-van Beiman & van der Stelt, 1986; Oller, 1980; Oller, Eilers, Urbano, & Cobo-Lewis, 1997; Warlaumont & Finnegan, 2016). By seven months of age the child reaches a biologically robust, developmental milestone where the articulation incidence of canonical syllables exceeds those that are less well-formed. Evidence suggests canonical babbling emerges slowly through language exposure that stimulates vocal motor learning, indicating it is a learned behavior rather than one that is present at birth (Ertmer & Nathani, 2010; Oller & Eihlers, 1988; Schauwers, Gillis, Daemers, DeBeukelaer, & Govarerts, 2004; Stoel-Gammon & Otoma, 1986). Delays in the development of canonical syllables extending beyond 10 months is an early warning that the child is at high-risk for language problems (Lohmander, Holm, Eriksson, & Lieberman, 2017; Ollers, 2000; Ollers, Eilers, & Basinger, 2001). Late onset of canonical babbling has been found to be predictive of smaller expressive vocabularies at 18, 24, and 30 months that put the child at-risk for poor literacy development (Fasolo, Majorano, & D'Odorico, 2008; Lee, 2011; Ollers, Eilers, Neal, & Schwartz, 1999).

### **Language interaction.**

How much and in what context infants hear language matters to its development which by age two predicts reading achievement through the fifth-grade (Lee, 2011). Language input is characterized by the joint engagement between the infant and others. These language interactions are marked by the shared routines, flow, quality of the language, and the degree to which they are connected (Cartmill et al., 2013; Goldin-Meadow et al., 2014; Huttenlocher et al., 2010). For example, Iyer, Denson, Lazar, and Oller (2016) studied infants 2 to 11 months old to assess volubility across three different social circumstances. The authors found volubility was dependent upon the social conditions surrounding the infant. Volubility was highest when the infant was alone with the primary caregiver with no differences found based on whether the caregiving was

speaking to the infant or remaining silent. Rates of volubility were significantly lower when the primary caregiver was involved in a third-party conversation as infants tended to listen to the conversation. This study suggests that context impacts how infants interact with language.

When speaking to infants adults often adjust their speech for comprehensibility, speak at slower rates, and use a higher pitch called *motherese* (Fernald et al., 1989; Gleitman, Newport, & Gleitman, 1984; Newport, Gleitman, & Gleitman, 1977). Adults also tend to carefully follow the infant's attentional focus, generate multiple utterances on the same topic, and pose questions to the infant for which they almost immediately provide a contingent answer (Gathercole & Hoff, 2009). Motherese increases the interest of the infant and has been shown to aid in language learning as the baby attempts to match its speech contours to the grammatical structures of others (Cooper & Aslin, 1994; Fernald, 1985; Hirsch-Pasek et al., 1987). Multimodal motherese is the synchronous use of speech, sight, and sometimes touch, to assist infants in the attachment of names to objects (Zukow-Goldring, 1997). In a study of multimodal motherese with infants from 5 to 30 months, Gogate, Bahrick, and Watson (2000) found that mothers are able to help their children learn novel words. Of importance is the use of temporal synchrony where mothers visually motion to the object while vocalizing its name, thus helping the child learn syllable-object relations. The authors found multimodal motherese was most often used with pre-lexical infants (5 to 8 months). Similar results were found in a study of Asian-Indian mothers where multimodal motherese was used to unify novel words and their referents (Gogate, Maganti, & Bahrick, 2015). While it is noted that motherese is not universal across languages which questions its importance to language development (Hoff, 2006), it has been established that children learn to identify structural information from speech. Evidence supports that children are sensitive to form-meaning correspondences and use this information to both predict and infer the properties of the language (Choi, 2006; Gathercole, 2006). The retention of such learning was explored in a study of 29 Korean-born babies adopted between the ages of 6 and 17 months by Dutch-speaking parents (Choi, Cutler, & Broersma, 2017). Even though the babies had been enculturated as Dutch-speaking children, the authors found that Korean linguistic information learned during very early childhood had been retained over 20 years later, suggesting the permanence of language-specific features learned early in life. Mueller and Hoff (2009) point out that if the learning of language involved only the mimicking of the most frequently heard words, then the child's initial production of words would be *the*, *of*, and *a*, which is not the case. This suggests that other input factors are more important than the frequency of word repetition. These include a critical mass of input from which the child can extract the necessary language that leads to acquisition (Conti-Ramsden & Jones, 1997; Elman, 2003; Gathercole, 2002a, 2002b). Additionally, the amount of language necessary to reach critical mass is thought to be linked to the extent to which the particular language pattern is transparent versus opaque with denser languages requiring a larger critical mass (Cain, Weber-Olsen, & Smith, 1987; Hernández Pina, 1984). Within this environment of words the infant begins to learn to connect them, one by one, to meaning. Of emerging importance to early language development is the presence of symbol-infused joint engagement, the communicative routines, and the fluency of the conversation between the infant

and adult (Hirsh-Pasek et al, 2015). These three types of verbal and non-verbal interactions when measured at 24 months were found to predict more than one-fourth of the difference in expressive language one year later.

### **Development of meaning.**

From environmental language “input,” infants quickly begin the process of developing meaning. Object categorization is the ability to generalize a newly acquired word to other appropriate referents. By 6 months of age infants have developed the ability to identify specific objects in their environment by linking the commonalities between them, thus promoting categorization and word learning before speech emerges (Fulkerson & Waxman, 2007). As in adults, domain-general processes facilitate these early stages of word learning and include mechanisms of learning, memory, selective attention, sensitivity to the intention of others, and retrieval (Bloom, 2000; Poulan-Buboïs & Graham, 2009; Samuelson & Smith, 2000). However, not all words are equal as some involve more concrete referents which make them easier to attribute meaning. To map a word to an object the infant must build a representation linking the word referent to the object. Before their first birthday the infant has developed a sophisticated understanding of objects that allows them to visualize it as three-dimensional, to track it across space and time (Spelke & Van de Walle, 1993), and to distinguish it from other objects (Johnson, 2004). The infant has also come to appreciate the permanence of an object when out of view (Baillargeon, 2004) and that the object has physical properties (Cohen & Oakes, 1993). More often these object characteristics are easier to distinguish in nouns than in verbs (Genter & Boroditsky, 2001) which privileges their learning (Bornstein, 2005; Golinkoff & Hirsh-Pasek, 2008; Maguire, Hirsh-Pasek, & Golinkoff, 2006). The action exemplified in verbs is more variant and less stable as a wide variety of exemplars make learning more difficult (Golinkoff et al., 2002). Parents are also more likely to encourage their children to pronounce nouns and act out verbs (Goldfield, 2000; Tardiff et al., 2005). What may be most important in determining which words are learned first is the ease with which a word can be mentally imaged (Paivio, Yuille, & Madigan, 1968). Although word imageability is not always high for nouns or low for verbs, it has been found to influence learning and memory (O’Neill, 2005; Williams, Healy, & Ellis, 1999) where words higher in imageability are learned at an earlier age (McDonough, Song, Pasek, Golinkoff, & Lannon, 2011).

### **Effect of Socio-Economic Status**

The depth and breadth of word knowledge is a distinguishing factor of one’s knowledge of language (Fruchter, 1948; Botzum, 1951; Wrigley, Saunders, & Newhaus, 1958). By the time children enter school vocabulary knowledge is strongly related to their general intelligence as well as to their linguistic and cognitive abilities including reading comprehension (Anderson & Freebody, 1981; Dupuy, 1974; Raven, 1948; Terman, 1918; Weschler, 1949). Word learning occurs in a predictable trajectory where at 12 months it is best described as languid as only about two words per week are acquired (Carey, 1978). By about 16 to 18 months children have acquired an average of 50 words (Diesendruck, 2009). Between 20 to 24 months children experience a

steep incline in word acquisition culminating in an estimated inventory of 10,000 words by age 6 (Anglin, 1993).

While language acquisition requires linguistic exposure the features of that exposure impacts and shapes its acquisition (Pinker, 1995). Remaining unclear for decades were the factors influencing individual differences in vocabulary acquisition. As recently as the late 1980s researchers attributed individual differences in vocabulary, to at least partly, the ability to learn which was thought to be accounted for by heredity (Huttenlocker, Haight, Bryk, Seltzer, & Lyon, 1991). However, failing to support this perspective were studies pointing out weak relationships between parent and child scores on standardized vocabulary tests (De Fries et al., 1976; Park et al., 1978; Scarr & Weisburg, 1978; Williams, 1975). Raising additional doubt was a study by Scarr and Weisberg (1978) showing strong correlations between vocabulary scores of mothers and their adoptive children commensurate with those of parents and their biological children, results which questioned heredity as a causal factor. Several studies suggesting a relationship between the amount of a mothers' speech and the breadth of vocabulary in their children offered an alternative to heredity for differences in vocabulary acquisition (Cohen & Beckwith, 1976; Ninio, 1980; Schachter, 1979; Tomasello, Mannle, & Kruger, 1986). Further, a study refuting the effects of learning capacity assessed vocabulary knowledge in children between 14 and 26 months of age (Huttenlocker, Haight, Bryk, Seltzer, & Lyon, 1991).

Research on vocabulary exposure has revealed that parents from lower-SES backgrounds speak less to their children (Hart & Risely, 1995; Gilkerson & Richards, 2009; Graves, 2006). Working from the perspective that vocabulary acquisition is malleable and not determined by genetic factors or learning ability, Hart and Risely (1995) found that SES was associated with large differences in vocabulary exposure and that children of highly educated parents were exposed to three times the amount of language than were children from less advantaged backgrounds. The authors determined that 86% to 98% of all vocabulary was shared between parent and child suggesting little vocabulary exposure came from outside the home. These differences in language exposure by age 3 predicted differences in literacy and academic scores at ages 9 and 10. From word choice to interaction style, Hart and Risely and other authors have found that children learn the language of their parents. (Hoff, 2003; Huttenlocher, Vasilyeva, Cymerman, & Levine, 2002).

Mother and father interaction with their young children is critical to language development as parental responsiveness has been shown to predict vocabulary size (Tamis-LeMonda, Bornstein, Kahana-Kalman, Baumwell, & Cyphers, 1998), eventual word diversity (Beckwith & Cohen, 1989), and the attainment of developmental language milestones (Tamis-LeMonda, Bornstein, & Baumwell, 2001). Tamis-LeMonda, Kuchirko, and Song (2014) suggest parent responsiveness is important because it supports pragmatic understanding as well as factors that facilitate word mapping and vocabulary growth including temporal contiguity, contingency, and multimodal gestures and didactic interactions. By 24 months of age productive vocabularies vary from 56 to 520 words (Fenson et al. 1994). Nonverbal gestural interactions are also important to word growth and take place between babies and their mothers. Increases in maternal gestures result in increased

gestures by the baby and have been found to predict vocabulary at 54 months of age (Rowe & Goldin-Meadow, 2009).

### **Schooling Effects**

Pre-school attendance has repeatedly been found to have little effect on vocabulary acquisition. Skibbe, Connor, Morrison, and Jewkes (2011) found that neither one nor two years of pre-school predicted vocabulary acquisition, however, chronological age was a significant predictor. Connor, Morrison, and Sliminski (2006) found no effect of schooling on vocabulary growth, however, independent play activities did result in vocabulary gains. Additional studies of vocabulary growth in kindergarten and first-grade have also found little growth due to school exposure (Christian, Morrison, Frazier, & Massetti, 2000; Morrison, Griffith, & Alberto, 1997). It has been suggested that the reason for no effect may be because little school time is devoted to vocabulary instruction (Neuman & Wright, 2014). Two meta-analytic reviews found very large effects for vocabulary-focused interventions. In an analysis of 64 studies where kindergarten or first-grade students were specifically provided vocabulary instruction an effect size equal to .88 (Hedge's  $G$ ) was found (Marulis & Newman, 2010). The authors also found that teachers and parents were equally effective in providing instruction (Hedge's  $G = .76$ ) while day-care providers yielded small effects (Hedge's  $G = .13$ ).

### **Developmental Language Impairment**

Of importance is the fact that some children, from 3% to 10%, may exhibit undiagnosed language development impairment that becomes apparent as they matriculate into pre-kindergarten or kindergarten (Tomblin et al., 1997). Specific language impairment (SLI) is present when oral language development lags behind other areas for no apparent reason (Leonard, 1998). Developmental dyslexia is identified when a child has difficulty acquiring literacy skills despite adequate intelligence, opportunity to learn, and appropriate instruction (Snowling, 2000). It is now common to see these two disorders lumped together and referred to as language learning impairment (Tallal, Allard, Miller, & Curtiss, 1997). Bishop and Snowling (2004) point out that while definitions often obscure the difference between the two, it is important to establish whether a child has problems with phonological processing or with language processing that is non-phonologically based and more global in nature. While a lengthy discussion of language impairment is beyond the scope of this review (see Bishop & Snowling, 2004), it is important that teachers be alert to children who present with speech irregularities and that they receive evaluation for possible impairments. Children who lag in isolating phonemes, for example, those who are unable to identify the initial sound in cat, cook, or camp, may have a phonological processing disorder that will complicate reading acquisition. It is important that teachers be alert for these irregularities and refer such children for professional evaluation.

### **Early Reading Development**

#### **Letter naming.**

Along with oral language and phonological awareness skills, the extent to which a child can name letters is one of the best predictors of later word-reading ability (Adams, 1990; Ehri,



1987, 1998; Piasta & Wagner, 2010; Scarborough, 1998; Schatschneider, Fletcher, Francis, Carlson, & Foorman, 2004; Whitehurst & Lonigan, 1998). When considering the instruction of consonant letters the sound structure of each becomes important. Treiman, Tincoff, & Richmond-Welty (1997) developed categories composed of those whose letter names were pronounced with two phonemes in consonant-vowel order (B, D, J, K, P, T, V, Z), vowel-consonant order (F, L, M, N, R, S, X), those pronounced using a single phoneme (C, G, H, Q, W, Y), while a fourth category contains all vowels. This is pointed out in relation to a randomized-controlled study with high ecological validity conducted by Pianta and Wagner (2010). This study compared the effects of three types of instruction, simultaneous letter naming and sound instruction, letter sound instruction only, and a control group who was taught number naming only. The authors found that first, letter naming instruction is important. Second, both letter names and sounds should be taught simultaneously rather than focusing on sounds or letter names as individual entities. In other words synergy was found in the interaction of teaching the two together. Third, simultaneous teaching of letter naming/sound instruction overrode the effects of those children with poor phonological abilities. Fourth, the sound structure of a letter (Treiman et al. 1997) had no effect on the ability of children to learn letter names for those receiving letter-naming/sound instruction. Fifth, the authors are careful to explain that for pre-K children at-risk for reading failure, teachers may need to consider the skills children bring into the classroom, meaning explicit instruction in phonological awareness is necessary.

Of importance to early literacy success is the ability to rapidly identify strings of objects, colors, digits, and particularly letters (Jansky & de Hirsch, 1972; Scarborough, 1998; Schatschneider, Fletcher, Francis, Carlson, & Foorman, 2004). This skill called rapid automatized naming (RAN) by researchers has been shown to be the single best predictor of later reading, but why? In early kindergarten while both letter knowledge and RAN accounted for unique predictive variance, the correlation between the two was very high. By the end of kindergarten this had significantly changed as the correlation between the two became much weaker (dropping from  $r = .73$  to  $.53$ ) with letter knowledge dropping in predictive power as many students now knew all 26 letters. Schatschneider et al. (2004) concluded that regardless of whether predicting first- or second-grade word identification, fluency, or comprehension from either the beginning or end of kindergarten, the three most powerful predictors of reading success are phonological awareness, rapid letter naming, and letter-sound correspondence knowledge. It should also be noted that multiple measures for vocabulary, syntax (both expressive and receptive), and visual perceptual skills were not useful predictors at this stage of early reading development.

### **Phonological awareness.**

While numerous studies have found a predictive effect for phonological awareness on reading ability, a study by Schatschneider et al. (2004) disentangles the nuances. At the beginning of kindergarten all three skills, letter-naming, phonological awareness, and rapid letter naming (RLN) were generally equal in their predictive value as they were similarly undeveloped in students. By the end of kindergarten all three skills were found to be the three largest and consistently significant predictors of reading ability at the end of first- and second-grade. While

end of kindergarten RLN had become the strongest predictor of reading fluency, each of the three predicted unique variance in reading ability including comprehension. The authors suggest that RLN taps the orthographic component of letters which overlaps with the letter's phonology, creating synergy that may account for more variance than either one alone. As in the Pianta and Wagner (2010) study discussed above, an interaction occurs between letter naming/sound with phonological awareness that can be used to leverage learning. In other words, simultaneous instruction of both creates a learning synergy, a finding supported by the National Reading Panel (National Institute of Child Health and Human Development, 2000). Of interest is that Schatschneider et al. (2004) found no predictive effects for end-of-kindergarten language on end of first- or second-grade reading. This result is similar to that found by Storch and Whitehurst (2002) where language did not predict reading comprehension until the third- and fourth-grade.

### **Word Reading**

Learning to read in first- through third-grade builds on the earlier knowledge gained by the child in recognizing the sounds of language (phonemes), identifying letters, and attaching those sounds to letters. Instruction becomes centered on the explicit teaching of letter-sound correspondences that link to the pronunciation and meaning of words (Ehri, 1980; Pefetti, 1992, Rack, Hulme, Snowling, & Wightman, 1994). Words can be read through decoding, analogizing to an already known word (can, fan, man), using context and letter clues to guess its pronunciation, and recalling the word from memory or what's called by sight (Ehri, 2005). It is estimated that a student admitted to a selective university recognizes about 80,000 words by sight (Hirsch, 2003). To learn this many words would require an average of 6,500 words per year be memorized. Fortunately there is a much faster method. A sight word is any word that when fixated on by the reader elicits retrieval from long-term memory resulting in instant pronunciation (Ehri, 2005). This single-step retrieval system of a unitized word is also called word automaticity (LaBerge & Samuels, 1974; Logan, 1988). Given that children taught through a look-say method require an average of 57 exposures to a single word, the task of building a sizeable sight-word inventory becomes out of reach for most students (Foshay, 1990). The more efficient strategy is to be taught the underlying letter-to-sound structures that form letter patterns within words (Ehri, 2005). By learning the alphabetic system the student develops recognition of letter-sound patterns which become secured in memory over several exposures (Share, 2004). Many sound patterns are transferable across words which strengthens the representation in the student's memory and shortens the time required to learn new words (Adams, 2002; Bhattacharya & Ehri, 2004). It is this ability of the brain to generalize what is learned to new word representations that results in what Share (2004) calls a self-learning mechanism that enables the rapid learning and conversion of thousands of words to sight-word status.

### **Fluent Reading**

Becoming a fluent reader (whether reading orally or silently) is predicated on the ability to pronounce the words correctly at a rate akin to that of conversation, and to do so with expression (Rasinski, Reutzel, Chard, & Linan-Thompson, 2011). Fluent reading is important because it

creates the working memory space necessary to allow the reader to focus limited attentional resources on comprehension (Perfetti, 1985; Perfetti & Hogaboam, 1975; LaBerge & Samuels, 1964; Posner & Snyder, 1975). Although being a fluent reader does not assure full comprehension, a lack of fluency makes it very likely it will suffer. Using his interactive compensatory explanation of fluency Stanovich (1980) explains that readers with poor decoding skills tend to rely on context-bound strategies that require large amounts of mental processing. On the other hand, good readers possess accurate, automatic, and almost effortless bottom-up decoding skills that consume almost no attentional resources. This leaves the reader able to apply top-down, contextually-dependent processes for making meaning of the text. Free of decoding troubles, the good reader has the cognitive space to integrate their existing schema with what they are reading. Critical to becoming a fluent reading is automaticity with a large inventory of words (LaBerge & Samuels, 1974; Stanovich, 1990).

Also important to fluent reading is prosody, the ability to reflect appropriate expression and phrasing of authentic oral speech when reading both orally or silently (Rasinski et al., 2011). It has been argued that prosody is critical to maintaining reading comprehension because as in oral conversation, prosody provides a kind of architectural framework that aids interpretation resulting from phrasing and expression (Cowie, Douglas-Cowie, & Wickman, 2002). Research has shown that as novice readers develop in their reading fluency they first focus on word identification accuracy and pronouncing the words smoothly (Paige et al., 2017). As the reader gains control over bottom-up decoding processes they are then more likely to apply characteristics of prosodic reading. This same study also showed evidence that prosodic reading mediates word automaticity and comprehension, meaning students who read with prosody are better able to comprehend.

By the end of third-grade the primary focus for school and district leaders is the percent of students attaining proficient status on accountability tests. While it would seem reasonable that students with appropriate letter-sound correspondence knowledge and fluent reading skills may be more likely to attain better outcomes on state assessments, this has not been studied until recently. Paige et al. (in press) studied 1,064 end-of-year third-grade students and obtained measures for spelling knowledge (a proxy for letter-sound correspondence) and reading fluency. The two combined measures representing foundational reading skills were then compared to achievement on the state-administered, end-of-year reading assessment. The authors found that while students not proficient in foundational skills had a 1 in 5 chance of achieving proficient or better status on the state reading test, students proficient in foundational skills had a 7 in 10 chance.

The research reviewed here is substantial which makes the challenge of transferring it into productive classroom instruction considerable. Section II reviews the connection between the research base and instruction.

## **II. Key Research Findings and Implications for Teaching**

### **Language Development**

Hoff (2006) states that while human language is biologically based it requires interaction with the social environment to develop, a view widely accepted by other researchers (Chapman,

2000; Baumwell, Tamis-LeMonda, & Bornstein, 1997; Landry, Miller-Loncar, Smith, & Swank, 1997). Additionally, numerous interventions based on a social-interactionist theory have been shown to accelerate language growth in both typical and atypical students (Whitehurst & Lonigan, 1998; Vasilyeva et al., 2006; Wasik et al., 2006; Whitehurst et al., 1988).

Differences in poverty-related language and socio-emotional domains of children have been a focus of numerous studies. A policy statement by the American Academy of Pediatrics (Council on Early Childhood, 2014) recommends that federal and state funding for children's books be provided to children at high-risk for reading disabilities during their supervised visits to pediatric offices. The statement also recommends that the promotion of literacy be included as an integral part of education for pediatric residents. This has followed research findings showing the use of pediatric providers to be a low-cost, low-intensity model for the promotion of literacy to parents of children at high-risk for reading failure (American Academy of Pediatrics, 2016; Cates, Wiesleder, & Mendelsohn, 2016;). A recent, robust study using a factorial, randomized control study investigates the results of treatment to address reading, attention, and hyperactivity issues in children from high-poverty households (Mendelsohn et al., 2018). In brief, the researchers randomly assigned newborns to a treatment/control condition. At age three, children were again randomly re-assigned to either treatment or control. This design enabled the analysis of additive and synergistic treatment effects. To begin, post-partum infants were randomly assigned to receive weekly, one-on-one, 30-minute sessions of play and shared reading activities designed by preschool experts. Treatment began when infants were two weeks of age and continued until they were age three and was delivered during visits to a pediatrician's office. A total of 275 families completed full treatment. Results at 1.5 years after program completion (age 4.5 years) showed reductions in attention problems ( $d = -0.25$ ), hyperactivity ( $d = -0.31$ ), and externalizing behaviors such as aggression ( $d = -0.24$ ). At age three students were randomly re-assigned to treatment and control groups with 252 families completing the double-dose treatment. Children in the treatment condition received 30 to 45 minutes of interactive curricula that focused on daily life themes such as going to the grocery store through shared story book reading, writing within play (making a grocery list for example), and focusing on the feelings of characters appearing in the stories. Results again showed reductions in aggression (-0.22) and externalizing problems (-0.26), and marginally significant reduction in hyperactivity (-0.26). For children receiving the double-dose of treatment, reductions were seen in attention problems (-0.38), hyperactivity (-0.63), aggression (-0.36), and externalizing problems (-0.54). This study provides strong support for treatment to reduce the effects of poverty using a pediatric-based delivery system.

### **Early Literacy Skills**

As children matriculate into pre-school and kindergarten, of concern is the instruction that best facilitates literacy acquisition. Emergent literacy is a developmental perspective that certain "skills, knowledge, and attitudes are presumed to be developmental precursors to conventional forms of reading and writing (Whitehurst & Lonigan, 1998, p. 849). The National Early Literacy Reading Panel ([NELP] Eunice Kennedy Shriver National Institute of Child Health and Human Development, 2008) conducted a meta-analysis of the existing research to identify

and rank the skills most correlated with pre-kindergarten or kindergarten outcomes for decoding, comprehension, and spelling. While correlations do not suggest a causative effect, they do provide evidence of the association among skills. The panel referred to documents by Snow, Burns, and Griffin (1998) and work by Whitehurst and Lonigan (1998) that identified precursor skills relating to later literacy skills. A useful conceptualization of these skills is one where *inside-out* skills refer to the recognition of print units within words that must then be connected to sound units that are transformed into units of language, while *outside-in* skills require the reader to place those language units within the correct conceptual and contextual framework (Whitehurst & Lonigan, 1998). Foorman et al. (2016) authored an IES Practice Guide that also recommends the teaching of foundational skills through third-grade. The Practice Guide presents these skills in relation to the strength of the empirical evidence supporting them. Skills that facilitate later letter-sound correspondence, decoding, fluent reading, and comprehension are as follows:

### **Strong Evidence**

- Letter naming: the ability to say the printed name of each letter (e.g., “b” is called b-ee)
- Knowing the sounds associated with printed letters (knowing that the sound of /g/ goes with G)
- Phonemic awareness: the ability to isolate and manipulate the sounds of spoken language. This includes the following skills:
  - Ability to break a word into syllables (to-day has two syllables)
  - Ability to delete a sound within a word and replace it with another (if you take away /b/ sound in bend you get the word end.
- Being able to rapidly name a list of letters, digits, colors, or familiar objects.
- Ability to write one’s name or simply isolated letters
- Being able to remember spoken language for a short period of time such as simple, multi-step instructions, or ability to remember the early parts of a story in order to make sense of elements occurring at the story’s end

### **Moderate Evidence**

- Knowledge of conventional print including:
  - Print is read from left to right
  - Distinguishing between the front and back of a book and understanding that it is read from front to back
- Recognize and identify environmental print
  - Read common signs or logos
  - Able to identify common company signs (e.g., McDonald’s)
- Able to put common thoughts into words and understand others when they speak
  - Possessing the vocabulary to discuss topics such a weather or insects
  - Ability to correctly order words when speaking

- Ability to distinguish differences in visual objects (e.g., upper-case letters are different from lower-case; pick out a stop sign from among other signs).

The NELP (2009) also recommends practices reflecting the current state of knowledge about early literacy learning and teaching. These include the following:

- Practices to encourage letter-name and letter-sound knowledge:
  - Games involving letters to teach letter names and shapes
  - Showing a set of letters and asking the child to name them in order as quickly as possible to develop letter-naming automaticity
  - Print upper- and lower-case letters on chart paper and ask the child to circle the capital letters
  - Explicitly teach letter names and sounds
  - Sing songs (or recite rhymes) that connect sounds to letters
  - Teach along a developmental continuum that moves from letter identification, to letter writing, to writing high-meaning words such as the child's name
- Activities that help the child 1) become aware of the sounds in language and 2) the manipulation of those sounds
- The use of rhymes, poems, and songs help students hear repetitive sounds at the beginning and end of words
- Take students from simple sound activities to those that are more complex
  - Combine sounds to make words: "Tooth" plus "brush" is what word? ..... "toothbrush"
  - How many *syllables* are in the word today? There are two: *to-day*
  - How can we break the word cat into two parts? *c-at* (onset and rime)
  - How many sounds are in the word cat? Three sounds: *c-a-t* (phoneme isolation)
  - If I remove the /c/ sound from *cat* and replace it with the /m/ sound, what word do I have now? The word is *mat*. (phoneme manipulation)
- Lead activities that help children to remember spoken information by asking them to follow simple, multi-step instructions.
  - Give instructions for activities such as playtime, lunchtime, morning circle time, clean-up following snack-time, etc.
- Conduct activities supporting oral language development
  - Conduct book read-alouds to expose children to rich language
  - Discuss the text with children by asking questions about the story sequence, development, and pictures
- Talk with children to encourage oral language skills
  - Extend discussions

- Engage children in interactive dialogs of new words, concepts, and letters and sounds
- Teach children how to ask questions (who, what, where, when, how)
- Help students to make comparisons between objects (hard versus soft)
- Leverage vocabulary to develop grammatical knowledge, definitional knowledge, and reading comprehension
  - To help students broaden their vocabulary make use of print that uses words in context, provides different meanings for the same word, and uses the word in different sentences
- When conducting an activity with a book help students see how the book “works”
  - Be sure students can see the print
  - Track the words with your finger while reading
  - Ask students for input by having them tell you what to write

### **Conventional Literacy Skills**

The National Reading Panel (National Institute of Child Health and Human Development, 2000) conducted a study of the empirical research base to determine the effectiveness of approaches for teaching children to read. From this work came a report finding what are now referred to as the Big Five areas of reading that undergird effective reading instruction that include phonological awareness and the subcomponent phonemic awareness, as well as phonics instruction, fluency, vocabulary, and comprehension. To determine the magnitude of a statistically significant finding the Panel calculated an effect size (Cohen’s  $d$  or just  $d$ ) which converts the outcome into standard deviation units that are then comparable across measures and studies. For example, an effect size of  $d = 1.0$  is the equivalent of a one standard deviation change. For example, on an assessment where the mean equals 100 (50th percentile) and the standard deviation equals 15, an effect size of  $+1.0$  equals a 15 point increase that makes the new mean equal to 115 (84th percentile). When discussing effect sizes the Panel considered statistically significant effects where a  $d$  between 0.2 and 0.49 is small, a  $d$  from 0.50 to 0.79 is moderate, and a  $d$  greater than or equal to 0.80 is large.

#### **Phonemic Awareness Instruction.**

English contains 41 distinct sounds from which all words in the language are composed. As reviewed earlier, infants become aware of and prefer phonemes of the language they hear around them. At the same time speakers are not aware of sounds at the phoneme level because words are typically composed of multiple sounds that are quickly and seamlessly folded together by the speaker. Phonemic awareness (PA) refers to the ability to focus on and manipulate phonemes in spoken words (NRP, 2000, p. 2-1). The Panel reported the following findings regarding phonemic awareness instruction:

- The Panel found clear evidence of the benefits of PA instruction with an overall effect of  $d = 0.86$ . PA was found to positively impact reading outcomes with an effect of  $d = 0.53$ . Additionally effects of PA remained strong over time ( $d = 0.73$ ).

- PA instruction helps all children, including those at-risk for reading difficulties, decode novel and pseudo-words and learn to spell ( $d = .59$ ).
- PA instruction was found to be most effective:
  - When teachers use explicit instruction
  - When children are taught to manipulate phonemes with letters
  - When instruction is scaffolded to the learner's developmental level
  - When instruction is focused on one or two types of phoneme manipulations rather than multiple types
  - When small group instruction is used (as opposed to whole-class or individual instruction).
- Children in pre-school and kindergarten benefit the most from PA instruction.
- PA instruction was found to take up to 20 hours with individual sessions lasting 25 minutes or less. More is not necessarily better as the largest effect sizes were for instruction lasting less than 20 hours.
- PA instruction is a means for helping children learn to isolate sounds to which they will later apply letters. As such, this makes PA a means to an end and is why it's important to insure students understand that phonemes match to individual letters and letter combinations.
- Children will vary in the time it takes to acquire PA, meaning children in first- and second-grade will vary in their skill with phonemes.
- Regular PA assessment is critical in order that the teacher understands the developmental needs between children and can then deliver the instruction that each child needs.
- PA instruction is not a reading program and does not insure children will read and write, rather, it is a critical foundational piece to literacy acquisition.
- PA is part of the larger umbrella of phonological awareness, the various sub-skills of which are acquired in a developmental sequence.
- The sequence in which PA skills is important as some are more difficult than others.
- Skills rank from easy (1) to difficult (6) as follows:
  1. Identify the first sounds in words
  2. Blend onset-rime units into real words (c-at; d-og; t-oy)
  3. Blend phonemes into real words (/d/ /o/ /g/ is dog)
  4. Delete a phoneme and then say the word that remains
  5. Segment words into phonemes
  6. Blend phonemes into non-words
- Phonological awareness begins with:
  - Identifying words that rhyme (hot, pot, not, cot)
  - Understanding that many words can broken into syllables (to-day)



- Phoneme isolation where individual sounds in words are identified. What is the first sound in the word *paste*? (/p/)
- Phoneme identity where the common sound in a group of words is identified (*bike*, *boy*, and *bell* each have /b/)
- Phoneme categorization where the odd sound is identified. What word does not belong – *bee*, *boy*, *stick*? (*stick* odd).
- Phoneme blending where a sequence of sounds are given separately that together form a word (/s/ /k/ /u/ /l/ is *school*).
- Phoneme segmentation: how many phonemes are in the word “*bat*?” (three: /b/ /æ/ /t/)
- Phoneme deletion where one recognizes the remaining word after a phoneme has been removed. For example, what is *smile* with the /s/ sound? (*mile*)
- The use of Elkonin boxes is useful for helping students identify sounds in words

### **Phonics Instruction.**

In 2000 the National Reading Panel conducted an exhaustive study of empirical research to determine the effectiveness of phonics instruction (National Institute of Child Health and Human Development, 2000). The major findings include:

- Systematic phonics instruction was significantly more effective than a no-phonics approach with average effect sizes of  $d = 0.44$ ). The NRP found no difference in effectiveness between approaches to phonics whether a synthetic, embedded, or a miscellaneous approach.
- Phonics instruction, when introduced in kindergarten and first-grade, is more effective than after first-grade ( $d = 0.56$  in K and 1st grade;  $d = 0.27$  in 2nd-through 6<sup>th</sup>-grade).
- Phonics instruction produces substantial growth in students at-risk for reading difficulties ( $d = 0.58$  for kindergarten and 0.74 for 1st-grade).
- Systematic phonics instruction was found effective at improving word- and pseudo-word reading ability ( $d = 0.67$  and 0.60 respectively).
- Phonics instruction improves spelling ( $d = 0.67$  for kindergarten and 1st-grade)
- Using a systematic approach to phonics instruction is effective regardless of socio-economic status ( $d = .66$  for low-SES and 0.44 for middle-SES).
- Systematic phonics instruction resulted in significant benefits in both randomized controlled trials and quasi-experimental trials ( $d = 0.45$  and 0.43 respectively).

Based on their review of the research the NRP drew several conclusions regarding phonics instruction.

- Phonics programs should not be considered as equivalent and interchangeable.

- Phonics instruction is a means to the end. Teachers must ensure that students apply their knowledge of letter-sound correspondence to reading and writing words, and becoming fluent readers.
- The Panel did not provide guidance on “how much” phonics instruction is enough.
- The role and motivation of the teacher in phonics instruction is critical. Significant consideration should be given to preparing teachers in the instruction of phonics.
- Phonics instruction is not a total reading program and consideration must be given to other elements including other evaluations of reading (e.g., fluency, comprehension, and interest in books).

### **Reading Fluency.**

Results of the National Reading Panel (2000) found in a meta-analysis that strategies falling under the umbrella of guided oral reading resulted in improvement of reading fluency with a weighted effect size of  $d = 0.41$ . Guided oral reading strategies included the neurological impress method, repeated reading, peer tutoring, shared reading, assisted reading, and the oral recitation method.

Since publication of the NRP results many studies have been published on aspects of fluency not covered in the report. Swanson et al. (2011) conducted a meta-analysis of the effects of storybook read-alouds on a variety of reading sub-skills in children 3 to 8 years old. The authors found significant effects in phonological awareness due to dialogic reading ( $d = 0.84$ ) and computer assisted read-alouds ( $d = 0.45$ ), while using repeated reading resulted in a huge effect of  $d = 2.59$ . Both dialogic reading ( $d = 0.60$ ) and computer-assisted strategies ( $d = 1.27$ ) were effective at increasing comprehension.

### **Vocabulary.**

The National Reading Panel (2000) made the following conclusions regarding the teaching of vocabulary:

- Vocabulary instruction aids comprehension
- The use of computer-based learning of vocabulary led to gains that exceeded traditional instruction
- Vocabulary learning can result from listening to others read and through incidental listening to storybook readings
- Repeated exposure to words aids vocabulary acquisition
- Pre-teaching vocabulary words to be subsequently encountered in a reading aids word learning
- Teach vocabulary words that will be encountered across multiple contexts
- Vocabulary learning is best when conducted through active engagement in learning tasks
- A variety of methods that foster multiple word exposures is more productive than a single teaching method and encounter with a word

### **Comprehension.**

Of the studies reviewed by the panel, the following conclusions emerged:

- The reader should monitor their understanding of the text during reading
- Students working cooperatively to learn strategies in the context of reading
- Graphic or semantic organizers where students write or draw their understanding of the relationships within the text
- Understanding story structure that is used to ask questions concerning the who, what, where, when, and why of the story; mapping of time lines, characters, and story events
- Student answers to teacher questions followed by teacher feedback as to their correctness
- Student summaries of the text that identify and integrate the main and supporting ideas into a coherent whole
- Flexible and appropriate use of multiple strategies by the student within a naturalistic context in interaction with the teacher

### **Studies Succeeding the NRP (2000)**

Marulis and Neuman (2010) conducted a meta-analysis of vocabulary instruction in kindergarten across 51 studies with the following results emerging (all effects calculated using Hedge's G):

#### *Explicit versus Implicit Instruction:*

Explicit vocabulary instruction resulted in greater growth than instruction that was implicit (effect size of 1.11 versus 0.62). A mix of explicit and implicit instruction was also effective (effect = 1.21), but not more so than explicit instruction alone.

#### *At-Risk and Low-SES Differences:*

Children at-risk for academic failure (not low-SES) grew in vocabulary knowledge with an effect = 0.85 while children not at-risk gained an effect = 0.91. The effect size differences were not statistically different from each other.

#### *Low-SES Differences:*

Children from a low-SES background grew with an effect = 0.75 compared to 0.99 for middle- and high-SES students, however the difference was not statistically significant.

#### *At-risk and low-SES:*

Children from a low-SES background who were at-risk for academic failure grew with an effect size = 0.77 while those students at-risk and from a high-SES background progressed with an effect size = 1.35. The difference in effect of 0.58 was statistically significant.

The authors concluded that vocabulary instruction has a significant impact on language development with an overall effect of 0.88, a result consistent with an effect of 0.97 found in a meta-analysis by Stahl and Fairbanks (1986).

The NRP found no studies substantiating the effects of silent reading because there were no studies published at the time meeting the Panel’s criteria. Subsequently, Reutzel, Fawson, and Smith (2008) implemented a randomized controlled trial comparing scaffolded silent reading to guided repeated oral reading in third-grade students. The authors found no difference between the two strategies in fluency and comprehension growth with both resulting in statistically significant increases. This study substantiates the effectiveness of silent reading when properly monitored by the teacher.

### **What Works Clearinghouse Practice Guide**

Foorman et al. (2016) authored the IES practice guide recommending the teaching of four broad foundational skills across kindergarten through third-grade (Figure 1):

1. Children should be taught academic language that includes the use of inferential and narrative language skills and accompanying vocabulary
  - Engage students in conversations that support the use and understanding of inferential language
  - Explicitly engage students in use of narrative language skills
  - Teach academic vocabulary in the context of other reading activities
2. Teach children the sound segments in speech (phonemes) and how they link to letters
  - Teach recognition and manipulation of the sounds of speech
  - Teach letter-sound relationships
  - Use word-building and other activities to connect knowledge of letter-sound relationships with phonemic awareness
3. Teach children to decode words, analyze word parts, and to write and recognize words
  - Teach students to blend letter sounds and sound–spelling patterns to produce a recognizable pronunciation
  - Teach common sound–spelling patterns
  - Teach students to recognize common word parts
  - Students should read decodable words in isolation and in text
  - Teach regular and irregular high frequency words to promote word automaticity
  - Introduce non-decodable words that are essential to the meaning of the text as whole words.
4. Students must read connected every day to support development of reading accuracy, fluency, and comprehension
  - As students read aloud, model strategies, scaffold, and provide feedback to support accurate and efficient word identification

- Teach students to 1) self-monitor their understanding of the text and to 2) self-correct word-reading errors
- Provide opportunities for oral reading practice with feedback to develop fluent and accurate reading with expression

Figure 1. WWC Recommendations by Grade

Kindergarten	First-Grade	Second-Grade	Third-Grade	Level of Evidence
<b>Recommendation 1</b> <i>(Language)</i>				Minimal
<b>Recommendation 2</b> <i>(Phonological Awareness and Letter Knowledge)</i>				Strong
<b>Recommendation 3</b> <i>(Decoding)</i>				Strong
<b>Recommendation 4</b> <i>(Fluency and Comprehension)</i>				Moderate

### Differentiated and Small-Group Instruction

While differentiated and small-group instruction are widely accepted, there are few studies documenting its effectiveness in elementary school settings. Several studies conducted since the NRP (2000) review have found that differentiated, small-group reading instruction is effective for teaching reading in the elementary grades (Connor, Morrison, & Slominski, 2006; Connor et al., 2011; Reis, McCoach, Little, Muller, & Kanisan, 2011). Connor et al. (2006) found that implementing alphabet and letter-word identification instruction was about ten times more effective when conducted in small groups versus whole-class settings. Connor et al. (2011) found effects of  $d = 0.64$  when comprehension instruction was delivered on a differentiated basis to third-grade students. Reis et al. (2011) studied differentiated versus whole-class instruction on reading fluency attainment across second- through fifth-grade with results supporting differentiated instruction.

### Instructional Dosing

Borrowed from the medical community, dosing refers to the amount of intervention delivered to the recipient with longer or greater quantities of dosing thought to be better (Ramey & Ramey, 2006) although others disagree (Halle, 2010). The results of a second meta-analysis by Marulis and Neuman (2013) analyzed additional features of vocabulary instruction. Again, effect sizes are reported using Hedge's  $G$ .

#### *Training Frequency:*

The median number of training sessions employed across all studies was 30 with no statistically significant differences in the effect size between those grouped as delivering fewer

than 30 sessions or those delivering more. Effect size was equal to 1.00 for 30 sessions or less, and .94 for those greater than 30 sessions.

*Session Duration:*

Duration is the number of days across which the intervention was delivered. The median number of days was 56 days with no statistically significant differences between those delivered across a shorter or greater number of days. For training delivered in 56 days or less effect sizes were equal to .83 while for treatment durations greater than 56 days effect size equaled 1.03.

*Intensity:*

The length of each session ranged from 7 to 60 minutes with a median of 20 minutes. Here again, no statistically significant difference was found for intensity while effect size equaled 1.16 for sessions lasting 20 minutes or less and 1.12 for those lasting longer than 20 minutes.

*Instructional Provider Effects*

This analysis looked at the extent to which learning varied depending on who delivered the instruction by comparing teachers, to parents, and child-care providers. Results showed clear differences with teachers being the most effective (effect size = 1.25), followed by parents (effect size = .71), while non-certified child-care providers were statistically and substantially less effective (effect size = .21) than the other two groups.

**Conclusion**

This section has reviewed the research regarding effective reading instruction. Informing this part of the review are major studies commissioned by the government as well as others presenting the results of well-done studies. The various reports more often than not congeal on similar instructional objectives for the effective teaching of reading that provides a solid foundation upon which to train teachers. The next section reviews productive techniques for training teachers.

### **III. Professional Learning**

The Peter Effect states that one cannot give what they do not possess (Applegate & Applegate, 2004). Increasing evidence suggests that elementary teachers are generally poorly prepared by schools of education to be effective reading teachers as they do not possess the requisite expert knowledge (Applegate & Applegate, 2004; Binks-Catrell, Washburn, Joshi, & Haugen, 2012; Johsi et al., 2009; Reutzel et al., 2009). Subject-matter expertise is both subject knowledge of reading and the specialized knowledge for how to teach it. Dickinson and Caswell (2007) found moderate to large effects for subject-matter expertise on both higher-quality practice and student achievement outcomes. Professional development is one mechanism used across districts to improve content knowledge at an estimated national cost of \$18 billion per year (Boston Consulting Group, 2014; Darling-Hammond & McLaughlin, 1995). In professional development teachers participate in structured learning within the professional environment which hypothetically leads to changes in teacher practice and hence, improved student outcomes (Darling-Hammond, Hyler, & Gardner, 2017). Unfortunately, a very small number of PD studies

have shown that what was learned in PD resulted in better student outcomes (Yoon, Duncan, Lee, Scarloss, & Shapley, 2007). Hill (2009) and Whitehurst (2002) both write that too many PD initiatives are led by individuals with insufficient content knowledge that results in poor PD quality, little transfer to practice, and recommendations that are incoherent with best evidence. Helpful in understanding what makes effective PD is an examination of how expert knowledge differs from that which is not.

### **Novice Versus Expert Knowledge**

Critical to improving the expertise of teachers through PD is an understanding of how humans learn and eventually become experts (National Academy of Sciences, 2004). A place to begin is by identifying what experts do:

1. Experts notice meaningful features and patterns in information.
2. Experts acquire a significant amount of content knowledge that is organized in ways reflecting deep understanding of the subject.
3. Deep content knowledge allows experts to understand “how it works,” that then guides them in “what to do.”
4. Rather than sets of facts, expert knowledge is driven by context and circumstances.
5. Experts can flexibly retrieve important aspects of their knowledge with little effort.
6. Experts vary their flexibility as they approach new situations.

In a general sense learners, particularly adult learners, leverage what they already *know and believe* to construct new knowledge and understanding. It follows then that teaching must help students identify both their accurate understandings and beliefs as well as those that may be either incomplete or actually false. The explicit uncovering of false beliefs regarding subject matter is critical so as to avoid new learning that is very different from that intended by the teacher (Vosniadou and Brewer, 1989). This leads to three fundamentals regarding how adult learners are taught:

1. The learner’s initial understanding must be engaged otherwise they may fail to grasp new learning.
2. To develop competence students must develop deep declarative knowledge, organize the knowledge within a conceptual framework, and then be able to easily retrieve their knowledge for application.
3. Taking a metacognitive knowledge approach to instruction encourages students to take control of their learning through the identification and of learning goals and the monitoring of their attainment.

From these understandings implications for successful PD include:

1. Pre-existing understandings must be drawn out by teachers.
2. Foundational knowledge of the subject matter must be taught in-depth with multiple examples.
3. Metacognitive skills must be integrated into the curriculum
4. Teaching must be knowledge centered that includes the why, how, when, and where of the content.

5. Students must be made aware of why particular subject matter is taught and what competence of the subject looks like.
6. Formative assessment is critical to informing the teacher on what students understand and are thinking in order to monitor learning and inform future instruction.
7. Learning is influenced by the context and community within which it occurs. This requires the development of classroom norms and expectations and a “growth mindset” (Dweck, 2010).
8. Learning is most productive when students engage in “deliberate practice” and actively monitor their learning (Ericsson & Pool, 2017).

### **Sustaining Change “At-Scale”**

Oftentimes districts rush to bring a change initiative to “scale” with little consideration of what it really means, the consequences of which result in poor implementation and little to no improvement in the intended student outcomes (Elmore, 1996; McLaughlin & Mitra, 2001). Coburn (2003) identifies four indicators that deep and sustainable change has occurred. *First*, deep change resulting in new and sustained approaches to instruction must alter teachers’ beliefs, pedagogical practices, and social interaction with colleagues. This means teachers must fundamentally alter their underlying assumptions about learning, the specifics of their content knowledge, and their subsequent instruction. In other words has the reform caused teachers to alter what they do and think? *Second*, change that is consequential must be sustained over years, a point inter-related with the first. Teachers who have deep knowledge of the theory and pedagogical principles undergirding a reform are better able continue its implementation in the face of new disruptions. These include changes to the teaching and school context, as well as to subsequent interventions that may actually attempt to counter-act the reform (Coburn & Meyer, 1998; McLaughlin & Mitra, 2001). *Third*, the idea of the spread of a reform goes beyond a horizontal conceptualization involving additional classrooms and schools to one of a vertical spreading that is up and down. For example, the reform is not simply extended into classrooms, rather, it becomes increasingly embedded within the pedagogical culture of the classroom. Conversely, the reform spreads up to become part of the policies, procedures, and professional development culture of the district. The *fourth* and last attribute identified by Coburn (2003) is that the reform is no longer thought of as an external change introduced by a reform sponsor. Rather, the reform has become part of the teaching, school, and district culture that now has developed the capacity to implement, sustain, and deepen the reform principles.

### **Teacher Self-Efficacy**

Individuals with low self-efficacy in achieving a goal-specific outcome have little belief in their ability to achieve a positive outcome, so placing effort in such an endeavor is seen as futile (Bandura, 1997). Teacher self-efficacy is a perception of one’s ability to positively influence a student’s orientation and successful transmit to them content knowledge (Guskey & Passaro, 1994). Bandura (1997) states that self-efficacy is a context- and task-specific construct that has been shown to vary within teachers and across content and grade areas (Raudenbush et al., 1992;



Ross et al., 1996, 1999). Guskey (1986) has suggested that instructional improvement initiatives can fail when they do not consider what motivates a teacher to take part. Scribner (1999) found that when implementing a new reading initiative, teachers with low professional self-efficacy were unwilling to engage as they were unable to see how it might help them improve their professional competence. On the other hand, teachers with higher self-efficacy were more likely to take advantage of improvement opportunities. Timperly and Phillips (2003) suggest that teacher self-efficacy likely does not improve linearly, but rather, reflects an iterative improvement process shaped by interactive changes in beliefs, actions, and outcomes that build upon each other. As teacher self-efficacy improves during the life of an improvement initiative, so does the teacher's confidence in the ability to successfully implement the instructional changes (Stein & Wang, 1988). However, while self-efficacy is important, teachers have been found to over-estimate their own abilities (Cunningham et al., 2004). As such, an implementation dip in self-efficacy often occurs at the beginning of an initiative when teachers are confronted with evidence suggesting they are less knowledgeable than they had estimated (Ross, 1994; Stein & Wang, 1988; Woolfolk Hoy & Burke-Spero, 2005). Guskey (1988, 1989) states that attending to teacher self-efficacy is important as one's willingness to innovate can be considered both a cause and an outcome of initiatives to improve student outcomes.

### **Teaching Capacity**

The collective ability of a school faculty to improve instruction and hence improve student outcomes can be thought of as school capacity (Elmore, Forman, Stosich, & Bocala, 2014; Newmann, King, & Youngs, 2000). Research evidence has found that teachers have the largest effect on what children learn in school (Rivkin, Hanushek, & Kain, 2005; Rockoff, 2004; Rowan, Correnti, & Miller, 2002). Additionally, the effect of teachers is particularly beneficial for children from disadvantaged backgrounds. While the effect of teachers does not close the achievement gap, it is vital to narrowing it (Downey, von Hippel, & Broh, 2004). After studying 100 Chicago schools for 7 years, Bryk et al. (2010) affirm that improving teacher capacity is a necessary condition to improving student outcomes. Downey et al. (2004) identified 5 factors to explain differences between schools in their ability to implement effective PD:

1. A schools' initial capacity to effectively integrate human and social resources for professional development
2. Effective school leadership
3. Sufficient funding
4. Strong technical expertise from external agencies that is based on rigorous research
5. Strong policy support from the district and state

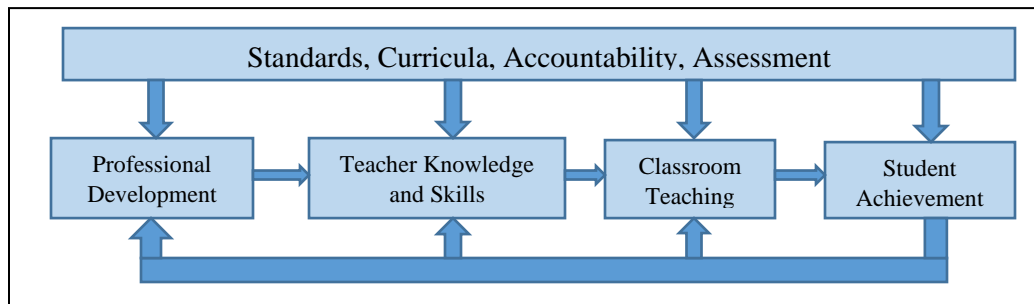
Unfortunately, high-poverty schools have the least amount of ability to improve teacher capacity (Goldhaber, Lavery, & Theobald, 2015). They are often led by weaker principals, provide fewer opportunities for teachers to collaborate, and lack the factors found effective at improving teacher capacity (Boyd et al., 2011; Kraft & Papay, 2014). At the same time it has been found that teachers are much more likely to implement effective instruction when PD is closely aligned with practice (Coburn, 2003; Cohen & Hill, 2001; Spillane, 2004).

## Professional Development

A meta-analysis published by the Institute of Education Sciences (Guskey & Yoon, 2009; Yoon, Duncan, Lee, Scarloss, & Shapley, 2007), as well as previous studies (Desimone, Porter, Garet, Yoon, & Birman, 2002; Garet, Porter, Desimone, Birman, & Yoon, 2001; Kennedy, 1998; Yoon, Garet, Birman, & Jacobsen, 2007) provides insights into professional development (PD) that has resulted in statistically significant improvement in student outcomes. Unfortunately, these reviews have uncovered only 9, well-implemented studies that have produced significant increases in learning. However, from those that have produced change, common characteristics can be identified. The following is drawn from Yoon, Duncan, Lee, Scarloss, and Shapley (2007) and Gusky and Yoon (2009).

1. Studies involving 14 or more hours of PD were more likely to show a significant effect on student achievement.
2. All studies uses a summer institute or workshop approach.
3. Support following initial training were part of all 9 studies.
4. The average effect of PD on student achievement was moderate (effect size = 0.54).

The authors point out that PD should be content-focused, intensive, coherent, well-defined, and well implemented. PD should also be reflective of a theory of teacher learning and change that has been empirically-validated such as the following:



Finally, the model should promote and/or extend effective curricular materials based on a validated theory of action.

The authors state that achieving high quality in the research design in order to draw causal inferences about teacher learning and change, is very difficult. The research design must have high internal validity through random assignment to rule out competing explanations for change. The research design must be able to distinguish the effect of PD from the value contributed by other curricular elements such as materials. A rigorous design must also have adequate power to detect true effects as well as adequate time between PD and subsequent measurement of teacher and student outcomes. There must also be high fidelity of implementation and the measurement instruments must have strong psychometric properties.

Darling-Hammond et al. (2017) comments that given the complex classroom environments faced by teachers, critical thinking, deep mastery of reading principles, complex problem-solving skills, effective communication and collaboration, and self-direction are essential. These authors suggest seven principles of effective PD that are found across successful initiatives.

1. PD is content focused on specific teaching strategies that support learning within the classroom context.
2. Incorporates active learning where teachers implement in their classrooms the strategies being taught in PD.
3. PD supports collaboration that allows teachers to share ideas and learning with each other.
4. Provides best-practice models of instruction.
5. Coaching and expert support is provided to individual teachers.
6. Duration of PD allows teachers the necessary time to learn, practice, and implement new strategies.
7. PD offers opportunities for teachers to receive input and make changes to their practice.

### **Web-Based Delivery**

Because of its popularity for providing flexible access across location, on-line instructional delivery has become popular in education (Angiello, 2010; Mean, Toyama, Murphy, & Baki, (2013). Shaha and Ellsworth (2013) refer to on-line, computer-based delivery of professional learning “on-demand learning” (p. 20) to call attention to the reason for its popularity. On-demand instruction has been developed to support considerable student interactivity, collaboration, and reflection, instructional characteristics important to face-to-face learning conditions (Rudestam & Schoenholtz-Read, 2010). However, a question of importance is the effectiveness of on-demand learning versus face-to-face (FtF) delivery modes. Sitzman, Kraiger, Stewart, & Wisher (2006) conducted a meta-analysis of 94 studies of university level courses. The authors found that on-demand and FtF course delivery models were equally effective for teaching declarative knowledge when the same instructional methods were used. Bernard et al. (2004) conducted a meta-analysis involving 232 studies and found on-demand delivery and FtF to be equally effective, although the authors stated that a large amount of difference existed in the effectiveness of both delivery methods. Zhao, Lei, Yan, Lai, & Tan (2004) conducted a third meta-analysis and like the others, found no differences in outcomes between OL and FtF delivery modes. As in other studies the authors found large differences between studies in the level of effectiveness. Unlike the other two studies the authors identified factors contributing to these differences. Studies published after 1998 were much more likely to find FtF more effective than OL. A factor is when the author of the study is also the course instructor there is a much higher probability that FtF out-performs OL. Student educational levels are also a significant factor. In FtF courses taken by graduate students there is no difference in outcomes when compared to OL delivery. Additionally, effectiveness of OL delivery is related to the course content. In business, computer science, and medicine, FtF courses resulted in better student outcomes while in the social sciences there is no difference between the two.

### **Engagement Makes a Difference**

Shaha and Ellsworth (2013) studied the influence of teacher engagement with on-demand professional development efforts and its effect on student outcomes in reading and math across 734 schools. The authors determined that greater engagement with on-demand professional

development beyond simply viewing the content resulted in greater student outcomes. For example, the researchers measured the number of forums and links that were viewed, the number of times students posted to forums and engaged in questions, and the number of files that were downloaded. Of the 21 observed engagement measures, teachers in more highly engaged schools were higher on 13 ( $p < .05$ ) than those in lower engaged schools. When measuring student reading outcomes, lower engaged schools moved achievement forward at a 4.9% year-over-year pace while gains at schools with high-engaged teachers were 18.0% ( $p < .001$ ). In math, low-engaged schools saw year-over-year student achievement improve at 0.5% ( $p < .05$ ) while high-engaged schools moved achievement by 18.9% ( $p < .001$ ). The salience of this study lies in the quality of on-demand participation rather than the quantity. On-demand professional development must engage teachers in active learning that is quickly transferred to practice. Passive viewing, whether in an on-demand or face-to-face environment, is likely to produce poor increases in student learning.

### **Micro-Credentials**

Micro-credentials provide educators with a route to earn formal recognition of skills acquired through professional learning opportunities. Within the micro-credential framework teachers engage in self-paced, job embedded professional learning that is rigorously connected to the daily skills needed in their classrooms. Acree (2016) reported results from an initiative in the Friday Institute within the School of Education at North Carolina State University where teachers were awarded micro-credentials for their professional learning. Lessons learned were as follows:

1. Teachers earning micro-credentials wanted to earn more
2. The micro-credential process motivated teachers to transfer skills to their classroom practice
3. Teachers engaged in the process at increased levels of rigor
4. Competency or mastery of skills can be demonstrated in multiply ways
5. The instructional design and the online platform upon which it resides is important
6. There is not a one-size-fits-all solution for micro-credentials
7. Micro-credentials is a new concept with much left to learn

### **The Role of Literacy Coaching and Mentoring**

Disagreements exist in academic corners arguing for differences between the terms coaching and mentoring but in practice they are used nearly interchangeably. Serat (2017) defines the two as being related where one engages in the processes of analysis, reflection, and action for the purpose of helping others and becoming competent in a skill- or performance-based endeavor through a coaching and mentoring cycle. Shanklin (2006) views coaching as a process involving classroom modeling, a supportive system for critiquing instructional practice, and observation. When well implemented, coaching and mentoring is a critical aspect of professional development that is effective for teacher training (Weaver, 2004). Through a process that embeds the coaching and mentoring process within the teacher's daily work, the teacher will initially focus changes on themselves. This is followed by re-focusing on the learning of their students (National

Commission on Teaching, 1996; Darling-Hammond & Baratz-Snowden, 2005). Neuman and Cunningham (2009) compared the effects of a 45-hour, 3 credit college course in language development plus coaching to teachers receiving only the course. Results of teacher practice observations revealed that those receiving coursework plus coaching significantly out-performed those receiving only coursework.

The Literacy Collaborative Model (LC) has been in existence for over 20 years with implementation in 500 schools spanning 6 states (Atteberry, A., & Bryk, A., 2011). Coaching is viewed within the model as a high-leverage strategy that can result in increases in instructional capacity and hence, student outcomes. Within the LC model coaches receive a year of training prior to assuming any coaching activities. Similar to the Newman and Cunningham (2009) model, coaches receive deep training in literacy theory and practice, as well as how to best support teachers. In their analysis of the LC model as implemented in 17 schools, Atteberry and Bryk (2011) found that over a three year period teachers received from 13 to 39 hours of coaching. While the amount of coaching teachers received increased over time as coaches became more comfortable with teachers, this wide variance is explained by other variables. The authors found that coaches were more likely to work with less experienced teachers and those with a greater pro-social orientation towards their colleagues, as well as those with a stronger commitment to their school. These three variables explained almost 16% of the variance in the amount of time coaches spent with teachers. Variables at the school level affecting coaching time include the size of the staff where larger faculties experienced less coaching time. Schools where teachers had more voice or control over decision making resulted in more coaching sessions per month per teacher. Finally, the amount of prior experience that a coach brought to the position in the areas of literacy and adult education resulted in more coaching time for faculty.

### **Summary**

This review has highlighted the various components that influence language and literacy acquisition and its' instruction from birth through third-grade. The review has also addressed teacher professional development including coaching, and the factors contributing to successful delivery of PD.

The research base investigating reading cognition is considerable, as is knowledge of effective reading instruction. However, much reading research has investigated narrow initiatives, most often instructional strategies conducted within a small number of classes or across several schools. While these studies provide important insight into what teachers should do in the classroom, they most-often do not explore the systemic approaches necessary for at-scale improvement. It is clear from national and state-wide reading evidence that narrowly focused approaches result in less-than-desirable improvement. The recently released reading results from the Nation's Report Card (U.S. Department of Education, 2017 [NAEP]) show no gain for 4th-grade reading results for the state of Georgia, in fact, the results are flat for the past 10 years, a result experienced by the majority of states. None the less, the opportunity exists for

implementation of systemic approaches to reading improvement that incorporate the various aspects of knowledge, instruction, coaching, and improvement discussed in this review. By adopting the perspective of a coherent improvement system, the research base contains optimism for at-scale solutions to improve reading outcomes.

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