Reading Fluency: How does it develop and how can we improve it in children with reading disabilities?

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How does phonemic awareness contribute to the acquisition of reading fluency?

Phonemic awareness has its initial impact on the growth of reading skill by helping children improve the accuracy of their “first guesses” at the identity of unknown words in text.
1. It helps children understand the alphabetic principle

Children must understand that the words in their oral language are composed of small segments of sound in order to comprehend the way that language is represented by print.

Without at least emergent levels of phonemic awareness, the rationale for learning individual letter sounds, and “sounding out” words is not understandable.
In order to begin to use the alphabetic principle in reading, children must have knowledge and skill in three areas:

1. Letter-sound knowledge

2. Basic phonological awareness

3. Ability to use context to help identify words once they are partially decoded phonetically.
2. It makes it possible to generate possibilities for words in context that are only partially “sounded out.”

The boy ________the dog in the woods.

The boy ch ___ the dog in the woods
Growth in “phonics” ability of children who begin first grade in the bottom 20% in Phoneme Awareness and Letter Knowledge (Wagner, Torgesen, Rashotte, et al., 1997)

![Graph showing growth in reading grade level for low and average performers.](image-url)
Growth in word reading ability of children who begin first grade in the bottom 20% in Phoneme Awareness and Letter Knowledge  (Wagner, Torgesen, Rashotte, et al., 1997)
Some phonological humor….  

Deficits in phonemic awareness create problems for many children, but they can also be devastating for dogs.
“Ha, ha, Biff. Guess What? After we go to the drugstore and the post office, I’m going to the vet’s to get tutored.”
To summarize….

Early development of phonemic awareness is important to reading development because it helps students acquire phonemic decoding skills, which improves reading accuracy.
The most widely accepted definition of fluency

“Fluency is the ability to read text quickly, accurately, and with proper expression”
National Reading Panel

Since we know that prosody is at least partially an index of comprehension...

Fluency is the ability to read text quickly, accurately, and with good comprehension
However, because it is difficult to measure both prosody and comprehension with a brief test on a large scale,

and because reading rate is strongly correlated with comprehension….

Most schools set their end-of-year targets, or benchmarks for reading fluency in terms of oral reading rate - the number of words per minute that can be read correctly on a grade level passage
Factors that might potentially influence oral reading rate

1. Proportion of words in text that are recognized as “sight words.”
2. Speed with which sight words are processed - affected by practice or individual differences in basic processing speed.
3. Speed of processes used to identify novel or unknown words -- phonetic decoding, analogy, context.
4. Speed with which word meanings are identified.
5. Speed at which overall meaning is constructed
6. Contextual affects on speed of word recognition-the “comprehension effect”
7. Individual choices about the trade-off between speed and accuracy
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7. Individual choices about the trade-off between speed and accuracy
These are interesting and challenging times for anyone whose professional responsibilities are related in any way to literacy outcomes among school children. For, in spite of all our new knowledge about reading and reading instruction, there is a widespread concern that public education is not as effective as it should be in teaching all children to read.
The report of the National Research Council pointed out that these concerns about literacy derive not from declining levels of literacy in our schools but rather from recognition that the demands for high levels of literacy are rapidly accelerating in our society.
What is a “sight word”?

“Sight words are words that readers have read accurately on earlier occasions. They read the words by remembering how they read them previously. The term sight indicates that sight of the word activates that word in memory, including information about its spelling, pronunciation, typical role in sentences, and meaning” (Ehri, 1998)

“Sight of the word activates its pronunciation and meaning in memory immediately without any sounding out or blending required. Sight words are read as whole units with no pauses between sounds” (Ehri, 2002)

“Sight words include any word that readers have practised reading sufficiently often to be read from memory” (Ehri, 2002)
According to our current understanding, a significant part of understanding how children become fluent readers by 3rd or 4th grade involves understanding how they learn to recognize many thousands of words at a single glance.

something  decide  money  then  said
The Surprise Party

My dad had his fortieth birthday last month, so my mom planned a big surprise party for him. She said I could assist with the party but that I had to keep the party a secret. She said I couldn’t tell my dad because that would spoil the surprise.

I helped mom organize the guest list and write the invitations. I was responsible for making sure everyone was included. I also addressed all the envelopes and put stamps and return addresses on them.
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The most complete current theory of how children form sight word representations has been developed by Linnea Ehri (Ehri, 1998, 2002)

The theory begins with the statement that “the process at the heart of sight word learning is a connection-forming process. Connections are formed that link individual written words to their pronunciations and meanings in memory.

The distinctive contribution of the theory is that it describes what kinds of connections are most likely used to remember sight words.
What are some potential connections that might serve?

Associations between the visual features of words and their meanings.

**Shape** -- **on**  **ate**  **tent**

**But what about** -- **stick, sting, sling, string, sink, stink, stick**

Sight word reading **must** involve remembering the letters in the words; these are the distinctive features that make one word different from another.
What are some potential connections that might serve?

However, if these letter sequences were linked arbitrarily to meaning, it would be a very difficult memorization task.

recognize something excitement

“A mnemonically powerful system is needed to explain learning as rapid as occurs for sight words.”

Further, if letters were connected arbitrarily to meaning, we would expect many more synonymous substitutions in reading.

Reading student for pupil Instead--puppet for pupil
mad for angry angel for angry
recover for found fund for found
Instead of arbitrary connections between visual features and meaning, Ehri’s theory proposes:

“..that pronunciations of words are the anchors for written words in memory. Readers learn sight words by forming connections between letters seen in spellings of words and sounds detected in their pronunciations alreading present in memory.

“When readers learn sight words, they look at the spelling, pronounce the word, and analyse how the graphemes match up to phonemes in that word. Reading the word a few times secures its connections in memory.”

For a reader with well developed phonemic awareness, the phonological structure of a word, which is already known, serves as a mnemonic for remembering the letters in its spelling.
“…readers learn to process written words as phonemic maps that lay out elements of the pronunciation visually. Beginners become skilled at computing these mapping relations spontaneously when they read new words. This is the critical event for sight word learning. Grapho-phonemic connections provide a powerful mnemonic system that bonds written words to their pronunciations in memory along with meanings. Once the alphabetic mapping system is known, readers can build a vocabulary of sight words easily. “
Relating the growth of phonemic decoding skills to the quality of orthographic representations required for recognizing words at a single glance.

Phases in development of word reading influence the quality of sight word representations.

Pre-alphabetic phase -- children do not use letter-sound connections to read words. They remember selected visual features.

Look  dog  spiderman
Partial alphabetic phase -- children form connections between some of the letters and sounds in words

Jail -- JL  house -- HS  clap  CP

Two kinds of weaknesses in word reading

1. Inability to completely segment sounds in words
2. Incomplete knowledge of sound-letter relations-- particularly vowels

Alphabetic phase -- children form connections between all of the letters and sounds in words. Representations are more complete, and reading is more accurate
As children’s increasingly developed phonemic skills lead to more detailed analysis of the internal structure of words in print, they begin to acquire increasingly explicit and more fully specified orthographic representations. However, if their phonetic skills do not develop, their orthographic representations are likely to remain incompletely specified, and they will be inaccurate readers and poor spellers.
Which is the real word?

smoak  smoke

circus  cercus

wagon  wagun

first  ferst

traid  trade
Consolidated alphabetic phase -- children form connections between frequent letter patterns (est, ing, at) and groups of sounds.

```
ch est
/  \
/ch/ /est/
```

```
in ter est ing
/  /  \\
/in/ /ter/ /est/ /ing/
```
Summary of the connection between reading fluency and phonemic awareness

1. A major factor that determines reading fluency is the proportion of words in a passage that can be recognized as sight words.

2. Phonemic awareness contributes to the development of sight words in two ways:
   A. It helps children to make more accurate “first guesses” when they encounter a word for the first time.
   B. It helps them use the phonemic structure of words as a mnemonic for remembering the letters in a word’s spelling. Thus, it is directly helpful in forming fully developed sight word representations in memory.
Implications for instruction

1. Phonemic awareness should be stimulated early in development as one key to accurate reading of words when they are first encountered in print

2. The growth of phonemic awareness should be monitored to insure that in attains the full phonemic level

3. Letter representations of all 44 phonemes should be taught

4. Young children should be encouraged and supported to do lots of reading-- there should be lots of opportunities for guided oral reading (reading with feedback).

5. Text that is specifically written to provide extra practice opportunities for high-utility "core vocabulary" words may be particularly efficient for building fluency through early acquisition of high frequency words in sight vocabularies
Examine outcomes from six clinical or experimental studies of remedial interventions with children from 10-12 years of age experiencing reading difficulties.

Three samples of severely disabled children with beginning word level skills around the 2nd percentile.

Two samples of moderately disabled children with beginning word level skills around the 10th percentile.

One sample of mildly impaired children with beginning word level skills around the 30th percentile.
Instructional Effectiveness Measured by Outcomes in Four Areas

**Phonemic Decoding Accuracy** -- skill at using sound-letter relationships to decode novel words

**Text reading accuracy** -- Accuracy with which individual words are identified in text

**Text reading fluency** -- speed of oral reading of connected text

**Reading Comprehension** -- accuracy with which meaning is constructed during reading

Outcomes measured in standard scores. An improvement in standard score means that a child is improving his/her reading skills compared to average readers. On all the measures used here, 100 is average.
A study of intensive, highly skilled intervention with 60 children who had severe reading disabilities

Children were between 8 and 10 years of age

Had been receiving special education services for an average of 16 months

Nominated as worst readers: at least 1.5 S.D’s below grade level

Average Word Attack=69, Word Identification=69, Verbal IQ=93

Randomly assigned to two instructional conditions that both taught “phonics” explicitly, but used different procedures with different emphasis

Children in both conditions received 67.5 hours of one-on-one instruction, 2 hours a day for 8 weeks

Children were followed for two years after the intervention was completed
<table>
<thead>
<tr>
<th>Activity</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phonemic Awareness and Phonemic Decoding</td>
<td>85%</td>
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<tr>
<td>Reading or writing connected text</td>
<td>5%</td>
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</tbody>
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Outcomes from 67.5 Hours of Intensive Intervention-LIPS

Standard Score

<table>
<thead>
<tr>
<th>Category</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Word Attack</td>
<td>96</td>
</tr>
<tr>
<td>Text Reading Accuracy</td>
<td>89</td>
</tr>
<tr>
<td>Reading Comp.</td>
<td>86</td>
</tr>
<tr>
<td>Text Reading Rate</td>
<td>75</td>
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</tbody>
</table>

30%
Time x Activity Analyses for an approach that emphasized guided reading of text with online correction and feedback (EP)

<table>
<thead>
<tr>
<th>Activity</th>
<th>LIPS</th>
<th>EP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phonemic Awareness and Phonemic Decoding</td>
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<td>5%</td>
<td>50%</td>
</tr>
</tbody>
</table>
Outcomes from 67.5 Hours of Intensive Intervention-EP

Word Attack: Standard Score = 90
Text Reading Accuracy: Standard Score = 88
Reading Comp.: Standard Score = 86
Text Reading Rate: Standard Score = 72
Oral Reading Fluency was much improved on passages for which level of difficulty remained constant

Absolute change in rate from pretest to posttest.

Most difficult passage

Pretest -- 38 WPM, 10 errors
Posttest -- 101 WPM, 2 errors

Next most difficult passage

Pretest -- 42 WPM, 6 errors
Posttest -- 104 WPM, 1 error
Growth in Total Reading Skill Before, During, and Following Intensive Intervention

Interval in Months Between Measurements

Standard Score

P-Pretest Pre Post 1 year 2 year

LIPS  
EP
## Major differences between Accuracy and Accuracy + Fluency Groups

<table>
<thead>
<tr>
<th></th>
<th>Accuracy</th>
<th>Accuracy + Fluency</th>
</tr>
</thead>
<tbody>
<tr>
<td>First 33 Hrs. 1:1</td>
<td>LIPS</td>
<td>LIPS</td>
</tr>
<tr>
<td>Next 50 Hrs. 1:1</td>
<td>LIPS</td>
<td>70% LIPS, 30% Fluency</td>
</tr>
<tr>
<td>Next 50 Hrs. Sm. Grp.</td>
<td>Extended LIPS</td>
<td>Comprehension--V V</td>
</tr>
<tr>
<td></td>
<td>Comprehension V V</td>
<td>Repeated reading practice</td>
</tr>
<tr>
<td></td>
<td>Accuracy Oriented</td>
<td>with text and word drills</td>
</tr>
<tr>
<td></td>
<td>Text practice</td>
<td></td>
</tr>
</tbody>
</table>
Outcomes from 133 Hours of Intensive LIPS + Fluency+ Comprehension Intervention
A Brief Description of the Spell/Read P.A.T. program

Distribution of activities in a typical 70 minute session:

40 minutes -- Phonemic awareness/phonics
20 minutes -- shared reading
7 minutes -- writing about what was read
3 minutes -- wrap up

Systematic instruction in phonic elements beginning with mastery of 44 phonemes at single syllable level through multi-syllable strategies. Fluency oriented practice from beginning of instruction. Discussion and writing to enhance comprehension.
A Clinical Sample of 48 Students aged 8-16

Middle and upper-middle class students
Mean Age 11 years
79% White, 67% Male
Received 45-80 hours (mean=60) hours of instruction
Intervention provided in groups of 2-4
Remedial Method: Spell Read P.A.T.
Mean beginning Word Identification Score = 92
Children with word level skills around the 30th percentile
Outcomes from 60 Hours of Small Group Intervention with upper middle class students—Spell Read

<table>
<thead>
<tr>
<th></th>
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<tbody>
<tr>
<td>Word Attack</td>
<td>114</td>
</tr>
<tr>
<td>Text Reading Accuracy</td>
<td>113</td>
</tr>
<tr>
<td>Reading Comp.</td>
<td>108</td>
</tr>
<tr>
<td>Text Reading Rate</td>
<td>99</td>
</tr>
</tbody>
</table>

30%
A Middle School Sample of 14 Students aged 11-14

Working class students

Mean Age 12 years

39% White, 64% Male

Received 37-58 hours (mean=51.4) hours of instruction

Intervention provided in groups of 2-4

Remedial Method: Spell Read P.A.T.

Mean Word Identification Score = 80

Children with word level skills around the 10 percentile
Outcomes from 50 Hours of Small Group Intervention with working class students—Spell Read

- **Word Attack**: 102
- **Text Reading Accuracy**: 90
- **Reading Comp.**: 94
- **Text Reading Rate**: 78

The dashed line represents a 30% cutoff.
A School-based, treatment control study of 40 students

60% Free and reduced lunch

Mean Age 12 years (range 11-14)

45% White, 45% Black, 10% other

53% in special education

Received 94-108 hours (mean=100) hours of instruction

Intervention provided in groups of 4-5

Remedial Methods: Spell Read P.A.T., Soar to Success

Mean Word Identification Score = 83

Children begin with word level skills around 10th percentile
Outcomes from 100 Hours of Small Group Intervention--Spell
Read

<table>
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<tr>
<th>Test</th>
<th>Standard Score</th>
</tr>
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<tbody>
<tr>
<td>Word Attack</td>
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30%
Summary and Conclusions:

1. For many older children with word level reading skills around the 30th percentile, a relatively brief (60hrs) dose of appropriate small group instruction can bring their skills in phonemic decoding, text reading accuracy and fluency, and comprehension solidly into the average range.

2. For many older children with word level reading skills around the 10th percentile, a more substantial dose (100hrs) of appropriate small group instruction can bring their skills in phonemic decoding, text reading accuracy, and reading comprehension solidly into the average range. Although the gap in reading fluency can be closed somewhat, reading fluency is likely to remain substantially impaired.

3. For older children with word level reading skills around the 2nd percentile, intensive interventions can have a strong effect on phonemic decoding, text reading accuracy, and reading comprehension, but they are likely to leave the fluency gap essentially unaffected.
Disparity in outcomes for rate vs. accuracy in five remediation studies

Accuracy
Rate

Beginning level of Word Identification Skill
What happens to accuracy and fluency of reading scores when children receive powerful preventive instruction?

Children were identified in kindergarten and received 21/2 years of preventive instructional support.

Curriculum featured multi-sensory, explicit instruction in phonemic awareness and phonics.

Children were taught 1:1 in 20 minute sessions four times a week: half the sessions were taught by well trained teachers, and half were taught by aides.
Follow-up growth in text reading accuracy

![Graph showing follow-up growth in text reading accuracy with standard scores for 2nd, 3rd, and 4th grades. The graph includes lines for PASP, EP, and NTC. The End of Intervention is marked on the x-axis.](image-url)
Comparison of Rate vs. Fluency for strongest group (PASP)

Accuracy = 99
Rate = 97

End of Intervention
Disparity in outcomes for rate vs. accuracy in remediation and prevention studies

- Accuracy
- Rate

Standard Score

Beginning level of Word Identification Skill

2nd grade 4th grade

Prev 1 Prev 2

30th
Our Current Hypothesis:

After problems with reading accuracy have been substantially remediated through intensive instruction, children remain dysfluent readers relative to age peers primarily because there are too many words in grade level passages that they still cannot recognize as sight words.
These are interesting and challenging times for anyone whose professional responsibilities are related in any way to literacy outcomes among school children. For, in spite of all our new knowledge about reading and reading instruction, there is a widespread concern that public education is not as effective as it should be in teaching all children to read.
If children are allowed to fall behind in the development of word reading skills in first, second, and third grade, they miss out on the many thousands of accurate word reading repetitions necessary to sustain normal growth in size of their sight word vocabulary.

Very low beginning word identification scores may signify a level of deficiency in sight word development that cannot noticeably be overcome during intensive interventions. Further, normal levels of reading practice following intervention cannot significantly “close the gap” with average children who are continuing to acquire sight words at a rapid pace in late elementary, middle, and high school.
Projected growth in “sight vocabulary” of normal readers and disabled children before and after remediation.
The major factor limiting reading fluency in older children with reading disabilities is a relative deficiency in the number of words they can read “by sight”.

which suggests…..

Once children become able to read text accurately, the major challenge in working with older disabled readers is how to engineer and focus reading instruction and practice so that development of “sight word vocabulary” is accelerated at a rate sufficient to “close the gap” in reading fluency.
Short texts to be read quickly with meaning.

60 texts each at grades 2, 3, 4.

Carefully structured to focus on 1000 most frequent words and important phonemic patterns

www.quickreads.org
Policy Implications arising from the combined outcomes of remedial and preventive studies

1. We must work **preventively** to eliminate the enormous reading practice deficits that result from prolonged reading failure, and that are a primary cause of difficulties in attaining fluent text reading skills.

2. We must find a way to provide interventions for older children with reading disabilities that are **appropriately focused and sufficiently intensive**. This type of intervention can produce dramatic improvements in older children’s text reading accuracy and reading comprehension in a relatively short period of time.

3. We still need to develop appropriately engineered practice activities to help close the gap in reading fluency once accurate reading skills are established.
Thank You