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Analysis of Spelling Errors: Developmental
Patterns and the Need for Continued
Instruction presented in partnership with
the American Board of Child Language
and Language Disorders (ABCCLD)

Ruth Huntley Bahr, PhD, CCC-SLP, BCS-CL

Moderated by:
Amy Hansen, MA, CCC-SLP, Managing Editor, SpeechPathology.com



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University of South Florida

Disclosures

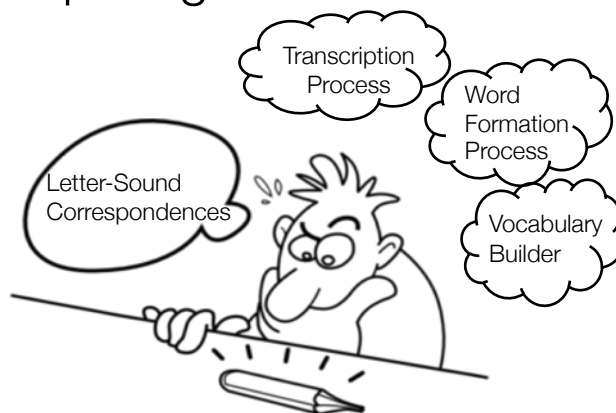
- Financial disclosures:
 - I am employed in a faculty and administrative position at a university.
 - I benefit financially from royalty payments from the sale of a book: Handbook of Communication Disorders, published by Routledge.
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- Non-financial disclosures:
 - I am a Board member for the American Board of Child Language and Language Disorders.
 - I serve on the Editorial Boards for the Journal of Research in Reading and Topics in Language Disorders.

Learning Outcomes

After this course, participants will be able to:

- Identify the cognitive and linguistic influences that affect spelling accuracy.
- Identify spelling strategies used by students as they learn to incorporate new vocabulary into written compositions.
- Describe how to incorporate spelling activities into lesson plans that target vocabulary and writing development.

What is Spelling?



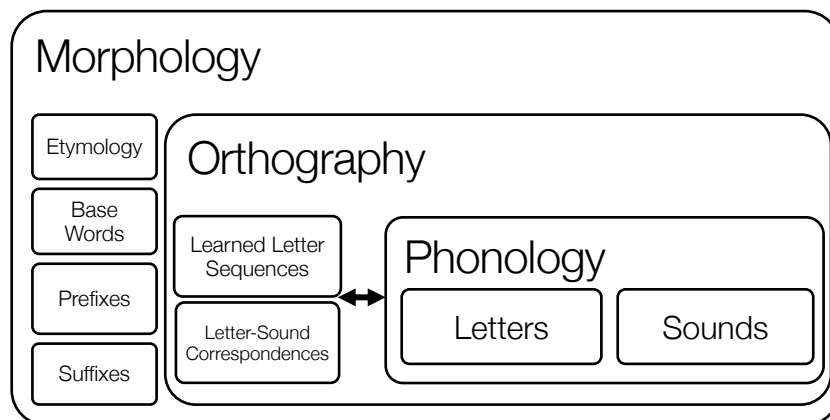
Q1

Spelling is a Linguistic Process

“Although spelling is often regarded as a mechanical skill, it is, to the contrary, a complex linguistic process without which writers could not generate written language.”

(Berninger, Garcia, & Abbott, 2009, p. 34)

Spelling as a Word Formation Process

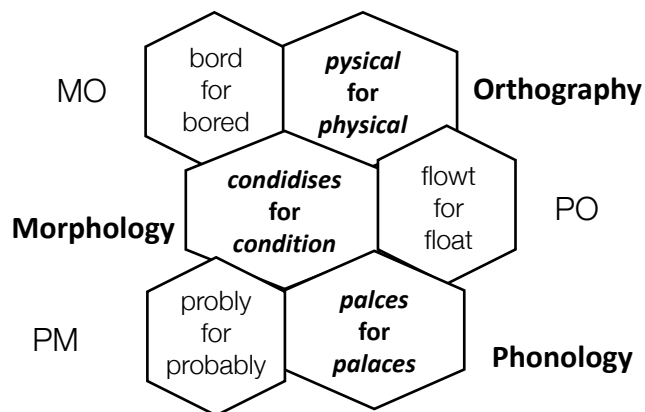


Types of Word Forms

(Berninger, Richards, & Abbott, 2015)

- Phonological word forms – Heard & spoken words coded in memory for storage & processing at both whole and subword levels (e.g., onset & rimes, syllables, phonemes)
- Orthographic word forms – Viewed & handwritten (or typed) words & their parts coded in memory for storage & processing as both whole and subword units (e.g., one or two letter groups or larger multi-letter groups)
- Morphological word forms – Regardless of input mode, words have morphology (e.g., root word without affixes or root with prefix or suffix)

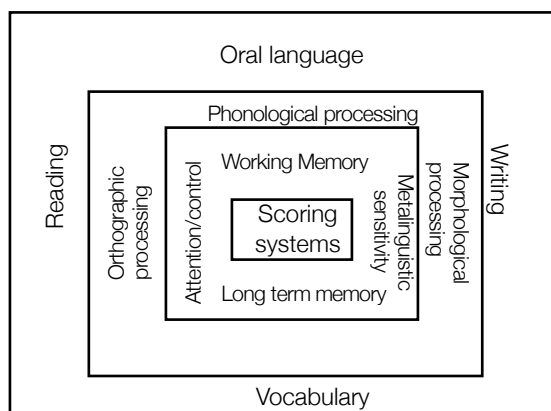
Misspellings Result from Incomplete Cross-Code Integration



(As described in Bahr, Silliman, & Berninger, submitted)

Q2

The Lens Model (Adapted From: Silliman & Wilkinson, 1991): Different Perspectives on the Generation of Spelling Errors



Q3

Scoring Systems and Spelling Errors

Scoring Systems & Phonological Plausibility (Bruck & Waters, 1988)



Constrained

- Orthographically acceptable letter sequences for a phonological spelling
 - reche for reach
- Can include structural and positional knowledge (Treiman & Bourassa, 2000)



Unconstrained

- A match exists between phonemes/graphemes - words are phonetically plausible
 - Phonological skeleton is preserved
 - rech for reach or necesite for necessity

Q4

POMAS

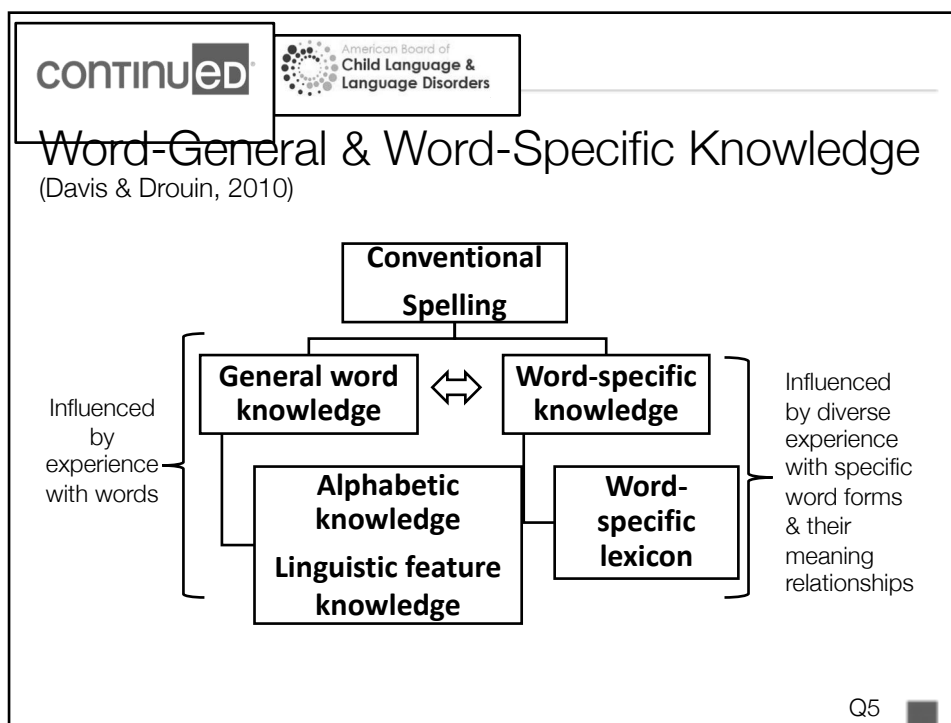
(Bahr, Silliman, Berninger, & Dow, 2012; Silliman, Bahr, & Peters, 2006)

- Phonological, Orthographic, Morphological Analysis of Spelling (POMAS)
 - Developed within a grounded theory framework
 - Permits a “bottom-up” analysis of linguistic feature in misspellings (more of an unconstrained approach)
- Phonological errors – include phoneme omissions or substitutions to the phonological skeleton of the target word.
- Orthographic errors – include letter substitutions and omissions that occur while the phonological skeleton is intact.
- Morphological errors – include errors involving word meanings, inflections, and derivations.

Quantification of Spelling Errors

(POMplexity) (Bahr, Lebby, & Wilkinson, 2019)

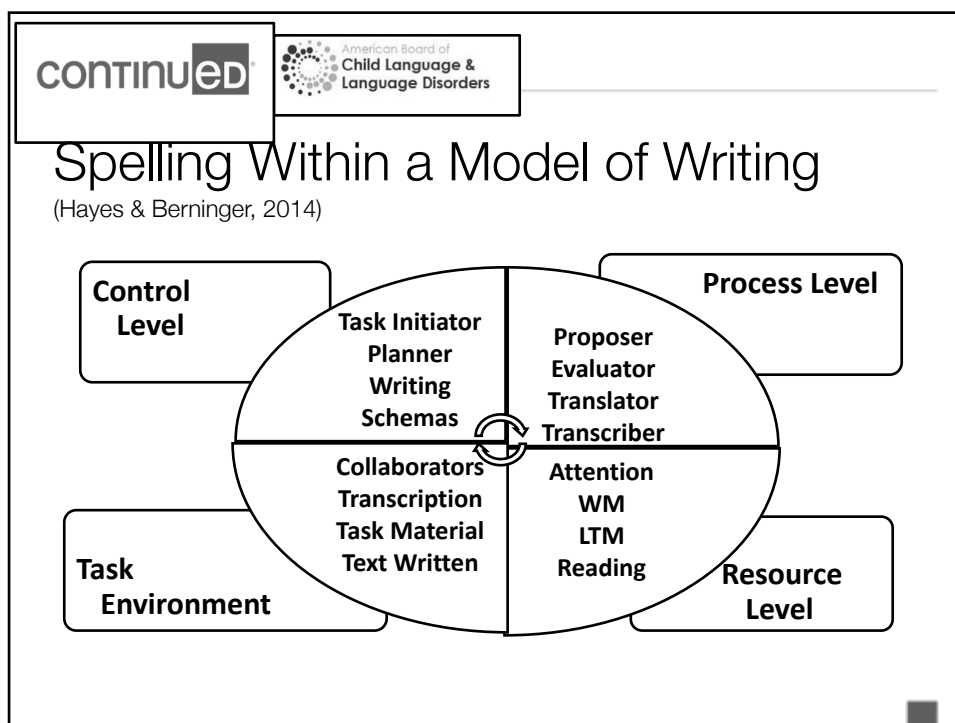
Spelling	POMAS code	POMplexity Score			
		P	O	M	Total
astronaut		0	0	0	0
astornauts	POR (reversal)	.5	0	1	1.5
astronat	OVDI (V digraph)	0	1	1	2
astarenots	MRW (real word) POR (reversal) OVE (vowel error) OVDI (V digraph)	.5	2.5	2	5
asternots	POR (reversal) OVE (vowel error) OVDI (V digraph)	.5	2	2	4.5



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Spelling is Best Assessed within Writing

(Graham & Santangelo, 2014)



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Writing Samples: Grade 1 (Female)

Grade 1 Female

- Narrative - One day Michelle had the worst day at school cuss she did not hav a frenid her freid wher all sick she whus louley and her siter whus at scoolh but then oen of her frenids came it w
- Expository -- I like my dog because she is shbest to me she is fro win we got her she is a goldinlap because win we got. she Prite.

Writing Samples: Grade 4 (Male)

Grade 4 Male

- Narrative - One day Kevin had the worst day at school. He woke up in the morning, late for school. He went to school he was cranky. He tripped on the floor. Next he got in trouble for talking. After that he had a missing paper report for eleven assignments. At lunch time he had peanut butter sandwich and
- Expository - I like video games because they amuse me. I like them because other things are kind of boring. Also, I like playing them because they're fun. I mostly like spaceship games. Other things are not as fun. The good about them is theres alot to choose from. They have over a thousand diferent games to choose from.

Developmental Patterns

Typical Errors in Grades 1-4

Phonological	Orthographic	Morphological
Sonorant Cluster (ad / and)	Letter Name (cr / car or pale / pal)	Contractions (was'nt / wasn't)
Flap (pride / pretty)	Letter Sound (sereal / cereal)	Homonyms (their / there)
Final C Voicing (becus / because)	Digraph (sip / ship)	Inflections (bike / bikes)
	Vocalic r (sistr / sister)	
	Letter Reversal (boll / doll)	

Typical Errors in Grades 5-9

Phonological	Orthographic	Morphological
Diphthongs (arond / around)	Consonant doubling (untill / until)	Contractions (weve / we've)
Schwa (cinomin / cinnamon)	Short vowel digraph (th <u>a</u> ught / th <u>o</u> ught)	Homonyms (there / they're)
	Vowel error (fovorite / favorite)	Inflections (kiss / kissed)
	Letter name (lonly / lonely)	Derivations (practly/practically)

Q6

Quality of Error Changes with Age

(Most Frequent Error Types)

Grades	Phonological	Orthographic	Morphological
1-4	<ul style="list-style-type: none"> •Sonorant Cluster •Flap •Final C Voicing 	<ul style="list-style-type: none"> •Letter Name •Letter Sound •Digraph •Vocalic r •Letter Reversal 	<ul style="list-style-type: none"> •Contractions •Homonyms •Inflections
5-9	<ul style="list-style-type: none"> •Diphthongs •Schwa 	<ul style="list-style-type: none"> •Letter Name •C Doubling •Short V digraph •Vowel Error •Metathesis 	<ul style="list-style-type: none"> •Contractions •Homonyms •Inflections •Derivations

Q7

Errors Over Time are Principled

(Bahr, Silliman, & Berninger, submitted)

Target		Year 1	Year 2	Year 3	Year 4	Year 5
Charge	A	chare	carge	charge	charge	charge
	P	crg	chrg	carge	charge	charge
Design	A				disign	design
	P				disine	design
Whistle	A				whisle	whissle
	P				whisle	whistle
Strength	A				strenth	strenth
	P				streng	strength
Doubt	A				doubt	dought
	P				dout	dought
Excitement	A					exitment
	P					exitmant

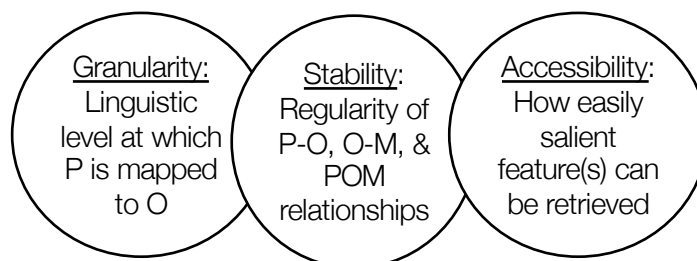
Applying General Word Knowledge with a More Linear Developmental Trajectory

Grade	Superior Speller
1	absent
2	absents
3	absense
4	absence
5	absence

3 Linguistic Variables Affecting Morphological Processing and Production in Spelling

(Newman, 2010)

- Children must implicitly attend to linguistic features to make connections between spoken language and their representations in spelling.



Granularity: Distributional Properties of Graphemes

(Bahr, Silliman, & Berninger, in review)

- Students must resolve phonological ambiguity
 - In 81 spellings of careless by typically developing students in grades 1-7, only 5 students (6%) used a grapheme other than c to represent the initial phoneme of the word.
 - There were 4 k and 1 ch
 - For conscientious, in all 28 attempts from the same students, the initial graphemes were c.
- Hence, the students were able to extract the distributional properties of the c grapheme at a fine-grained level.

Granularity: Applying General Word Knowledge via Recursion to Careless

(Bahr, Silliman, & Berninger, in review)

Grade	Poor Speller	Average Speller	Superior Speller
1	carls	carlisse	carell
2	cerles	karles	careless
3	carless	carlis	careless
4	carles	carless	carless
5	carless	careless	careless

Word-Specific Knowledge & Stability

Grade	Average Speller
1	excitment
2	excitement
3	ecxitement
4	excitement
5	excitement

Accessibility of Specific Word Forms

(Bahr, Silliman, & Berninger, in review)

- Poor Morphological Decomposition was noted in 2 ways:
 - Spelling of colloquial productions
 - dangerous as dangrous and favorite as favrot (in grade 5), usly for usually (grade 7) and diffrent for different (grade 8).
 - jewlery for jewelry (grade 5) and probilly for probably (grade 8).
 - Syllable parsing strategy is evident.
 - Weak integration of form and meaning with syntactic roles
 - addition for edition and patience for patients (homophones)
 - An alternate strategy was the inclusion of a real word as an orthographic image that represents the target phonology, as in exsightment for excitement or farmersuitical for pharmaceutical

Q8

Does the Presence of an SLD Result in Different Misspelling Patterns?

(Bahr, Lebby, & Wilkinson, 2019)

Grade 6, Dysgraphia (Pacific Islands)

there are 20000 to 30000 islands in the pasific ocean. it is sourounded by water and usally tropical like hawii its called oceania. a island like micronesia is lthe largest island and has mt fiji on it and guam and new zeland. the can also be called low islands some islands are called high mountains because they have volcanoes on them and the low islands do not have valcanoos so there called low islands. the low islands are not usally a place to go on a vacation because some islands might have a higher chance of floding or other water attacks. the end

10 errors/103 words




Lucy, 14 years old with Dyslexia Diagnosis (Grade 8) (Expository Text, 67 Words, 8 Clauses)

Astornots (astronauts) spend years tarining (training) for space travel thuoth (though) few aucull (actually) have the opertat (opportunity) to do so. The few astornots (astronauts) who do acive (achieve) the honer (honor) of being cho(z)sen (chosen) for space travel have to pass tests to see if they are fit for travel. These tests are both mentl (mental) and pysical (physical). After the basic math and staderd knowgle (standard knowledge) test they go to the tets (tests) that mimic spoce condidises (space conditions).

(Errors are in green; Blue are correct spellings of words that were in error previously).

Phonological processing errors are evident: aucull, opertat, acive, staderd knowgle, condidises




Jordan, 15 years old; OWL LD Diagnosis (Grade 9) (Expository, 68 Words, 11 Clauses)

What asternot (astronauts) do in spa(s)ce (space) is try to find stuff about the stares (stars) and plantes (planets) they talk (take) test. Asternots (astronauts) probly (probably) get lonly (lonely) and probly (probably) get bord (bored) sitting up in the space ship (spaceship). Asternots (astronauts) probly (probably) play games up in thear (their) ship they probly (probably) flowt (float) arond (around). Astore nots (astronauts) probly (probably) eat sam (some) food up in the space ship (spaceship). Astornots (astronauts) probly (probably) think its (it's) cool getting to travel throw (through) space. Thats (that's) what I think.

(Errors are in green).

Jordan produced 41 different words, repeated probably (6 times) and astronauts (5 times & spelled it 3 different ways). He relied on a sounding out strategy to spell.

Deficits in Reading and Oral Comprehension: Spelling Patterns

(Bahr, Lebbby, & Wilkinson, 2019)

Dyslexia (n= 8)

Misspellings = 197/978 (20%)

Misspelling Examples

- category/categories/categorized
 - catigorized, categoies, catagorys, categoies
 - Errors with schwa vowels, inflections, omissions
- classified
 - classafied, calssified, classifed, calasified, clasifid, callified, clasifide
 - Same as above & letter doubling

OWL-LD (n = 3)

Misspellings = 22/336 (7%)

Misspelling Examples

- category/categories
 - catogories , categories
 - Errors with schwa vowelsw
- classified
 - classufied, classiffied
 - Errors with schwa vowels & letter doubling

Educational/
Clinical Suggestions

English Spelling is Patterned (Not Illogical)

- Misspellings often signal attempts to reproduce the pronunciation of the target word when either general-or word-specific knowledge is incomplete, e.g., delicious.
- Individual differences are common.
- Instruction should include a focus on morphological transparency & syntactic roles
 - Misspellings can vary depending on multiple factors at any given time – Focus on the word, not the rule.
 - Integration of P, O, & M with syntactic roles continues through adolescence as new word-specific meanings are acquired.

Emphasize Word Patterns

Phonological Task: Match word patterns to their sounds (task for rhotic r)

- | | | | | | |
|--------|------|------|------|-------|-------|
| ▪ bark | girl | surf | hard | first | burst |
| ▪ fern | yarn | dirt | turn | dark | nerve |

Orthographic Constancy

Short Vs

witch

catch

hutch

Long Vs

teach

coach

each

Oddballs

rich

much

Vowel Pattern Contrasts

Sort into groups by vowel patterns to compare/
contrast long/short vowel -e spelling patterns

1. First sort by sound class

Long-e

cheap
priest
clean
niece

Short-e

men
shed
head
deaf

Goal: Consider BOTH sound
& pattern to discover
orthographic
consistencies

2. Next, sort by orthographic pattern

CVC

men
shed

CVVC

head
dead

ea

cheap
clean

ie

priest
niece

To Improve Spelling Accuracy: Be a Word Detective (Goodwin et al., in press)

- Strengthen the quality of student's lexical representations.
Focus on vocabulary building and morphological knowledge.
- Identify alternative spellings for specific sounds that are misspelled in students' writing.

- Example: Jordan spelled throw/through

The orthographic pattern -ough

bough [baʊ]

cough [ka]

rough [rʌf]

ought [ɔt]

dough [do]

The /u/ sound

food [fud]

blue [blu]

two [tu]

dude [dud]

you [ju]

through [θru]

brew [bru]

The Multidimensional Nature of Morphological Knowledge

(Goodwin et al., in press)

- 1) Identify units of meaning
 - Find base words –teach students how to identify morphemes – like astro and naut in the compound word astronaut and the base word in probable-probably, but not problem.
- 2) Use suffixes as syntactic devices
 - Have students select the correct complex morpheme to complete a sentence – The pilots wanted a _____ of the launching procedure. (demonstrate)

Q10

The Multidimensional Nature of Morphological Knowledge (Cont.)

- 3) Decode complex morphological words
 - Base form = astro = the Greek root which means star/space and naut = sailor
 - astronaut, astronomy, astrology, astrological, asteroid, asterisk
- 4) Use knowledge from reading to spell complex words (and vice versa)
 - Knowledge of the word operate should help in the spelling of operation.

Conclusions

- Spelling is a cognitive-linguistic activity that is influenced by availability of cognitive resources, linguistic processes, task control & task environment.
- Spelling errors are best observed while writing and when using an unconstrained system.
- Spelling errors represent one's current understanding of linguistic features and their organization.
- Students make similar errors for different reasons.
- Spelling errors change depending upon contextual factors.
- The focus should be on strengthening "word study" (Apel) skills.
- Treatment should occur with naturalistic writing. It does not have to be individualized.

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