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THE QUALITATIVE SIMILARITY HYPOTHESIS: RESEARCH SYNTHESIS AND FUTURE DIRECTIONS

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Abstract: IN THE PENULTIMATE ARTICLE of a two-part special issue of the American Annals of the Deaf examining the qualitative similarity hypothesis (QSH), findings of nine research teams with articles in the special issue are summarized. The teams addressed three questions: (a) For students who are d/Deaf or hard of hearing (d/Dhh), is reading qualitatively similar to the reading process of hearing students (per the QSH)? (b) Is it, rather, qualitatively different (per the qualitative difference hypothesis [QDH])? (c) Or is reading qualitatively similar and qualitatively different? All nine teams recognized that aspects of the reading acquisition process of d/Dhh children resemble those of hearing children and that the QSH is tenable if it is independent of a child's language modality. Two teams concluded that there is research supporting both the QSH and the QDH. Implications for teacher education, future research, and language policymaking are discussed.

Full text: Headnote

IN THE PENULTIMATE ARTICLE of a two-part special issue of the American Annals of the Deaf examining the qualitative similarity hypothesis (QSH), findings of nine research teams with articles in the special issue are summarized. The teams addressed three questions: (a) For students who are d/Deaf or hard of hearing (d/Dhh), is reading qualitatively similar to the reading process of hearing students (per the QSH)? (b) Is it, rather, qualitatively different (per the qualitative difference hypothesis [QDH])? (c) Or is reading qualitatively similar and qualitatively different? All nine teams recognized that aspects of the reading acquisition process of d/Dhh children resemble those of hearing children and that the QSH is tenable if it is independent of a child's language modality. Two teams concluded that there is research supporting both the QSH and the QDH. Implications for teacher education, future research, and language policymaking are discussed.

Keywords: reading, literacy, deaf education, reading theory, phonology, qualitative similarity hypothesis (QSH)

A book goes out there to a zillion different people, and everyone reads a different book because they bring their own imaginations to it.

LOIS LOWRY (2014)

Lois Lowry (2014), author of Newbery Award-winning children's books, stresses the importance of readers "bringing their own imaginations" to reading a book. Seth Lerer (2008), author of Children's Literature: A Reader 's History From Aesop to Harry Potter, says that the process of reading more books enables the reader to "chart the makings of the literate imagination" (p. 1). For education psychologists engaged in the scientific study and measurement of reading skills, reading acquisition entails a dimension of these skills. Drawing on data-driven studies, Mason, Stewart, Peterman, and Dunning (1992) constructed a tripartite model to explain reading acquisition, consisting of (a) developmental emergent literacy processes; (b) the cognitive processes that occur during word learning or word analysis, word attack, decoding, and application of the alphabetic principle; and (c) the socialcultural and constructivist processes of the reader. The literary world of Lowry and Lerer and the scientific world of educational psychologists represent complementary ways of understanding the different dimensions of the reading acquisition process.

The question of how d/Deaf and hard of hearing (d/Dhh; see definition in Wang &Andrews, 2014) children learn to read books has flummoxed past and present teachers and researchers. In this penultimate article of a two-part Annals special issue on the differences, if any, between d/Dhh and hearing readers in regard to the

processes of acquiring and using reading skills, we synthesize the diverse viewpoints of nine contributing teams of researchers from universities and research laboratories in the United States and Canada. We asked each team to critically examine the qualitative similarity hypothesis (QSH) as a conceptual frame so that we could arrive at a better understanding of how d/Dhh students learn to read.

We know that many d/Dhh students fail to learn to read; however, we also know that many d/Dhh adults do become skilled readers (Allen &Morere, 2012; Andrews &Karlin, 2002; Miller &Clark, 2011; Mounty, Pucci, &Harmon, 2014; Thumann, 2006). Some even become reading researchers (Andrews, Byrne, &Miller, 2015). Stronger reading skills have been attributed to the d/Dhh child's early access to language, whether it be visual, as in American Sign Language (ASL), or auditiorily based, even though some d/Dhh adult readers report that they learned language after the critical period in early childhood. Other researchers have found that motivation and higher amount of reading lead to greater reading proficiency on the part of d/Dhh readers (Pauralt &Williams, 2010). Still other researchers report that expert d/Dhh readers always have strong auditorily based phonological skills, which they can draw upon through speechreading, articulatory feedback, Visual Phonics, or Cued Speech (Wang, Tfezek, Luckner, &Paul, 2008). But did their phonological awareness lead to their higher reading achievement, or was their phonological awareness the outcome of being good readers? Is phonological awareness bidirectional? Some support the belief that phonemic awareness is the primary skill underlying the emergent literacy of young d/Dhh readers (e.g., Cupples, Ching, Crowe, Day, &Seeto, 2013), while others have a more expanded, richer view of emergent literacy that encompasses not only letter recognition and word-reading code emphasis skills, but also includes book-reading experiences, cultural aspects, world knowledge, concept development, drawing, and letter writing, as well as parent and teacher practices related to the book-reading experiences of children (Andrews &Mason, 1986; Herbold, 2008). Indeed, a current of divergent ideas and unanswered questions flows through reading research in deaf education.

For this issue of the Annals and the one preceding it (Vol. 159, nos. 4 &5), which together constitute a two-part special issue, researchers analyzed effective intervention studies proven effective with hearing, English Language Learner, special, and d/Dhh populations (Wang &Williams, 2014). Others researchers are working at identifying malleable or changeable factors in the classroom as well as the role of fingerspelling as an alternative to phonological processing (Easterbrooks et al., 2015). Some are examining socioeconomic status (SES) factors related to ASL and English reading achievement (Twitchell, Morford, &Hauser, 2015). Others are examining latent or underlying factors such as early sign language and alphabet knowledge (Allen, Letteri, Choi, &Dang, 2014). Others have considered whether d/Dhh readers need visual exposure to the phonemic structure of the English language by means of Cued Speech (LaSasso &Crain, 2015). Still others note the importance of having exposure to the phonological sensitivity of the English language prior to learning about the phonological and phonemic aspects of decoding print (Mayer &Trezek, 2014). If the children in these studies are signing d/Dhh bilinguals, then researchers are interested in how they develop ASL/English strategies (see reviews in Andrews et al., 2015), including how they use their visually based sign language phonology to map onto English print (Allen et al., 2014; Andrews et al., 2015; McQuarrie &Parrila, 2014).

We believe that the QSH offers a fertile field where researchers with diverse perspectives can cross-pollinate and share ideas about their understanding of the reading process. We hope that the articles in this twopart Annals special issue will provide opportunities for researchers to partner to find solutions with each other as well as with their students. While the QSH (or its variations, such as the qualitative difference hypothesis, QDH) does not purport to capture the full nature of reading in its multifaceted dimensions for such a heterogeneous population as d/Dhh readers, we view it as an anchor point. So whether one's theoretical ship sails under the QSH flag or not, the theory provides a place to begin navigating through the complex process of understanding how other researchers think and write about d/Dhh children learning to read.

We envision the articles in this special issue evolving into a text that will continue the conversation in more detail and with more participants, which can thereby influence our students, the next generation of reading

researchers. Few of us would contest the point that d/Dhh children have multiple sensory pathways for learning about reading-both auditorily, with or without technology such as cochlear implants and digital hearing aids, and visually, as in the case of signing d/Dhh bilingual students. Some children may even use both paths in various capacities at different times in their schooling and then into adulthood. Further, few of us would contest the view that the approach to the scientific study of reading for d/Dhh students should include multiple instead of single epistemologies or knowledge bases (Wang, 2010), or the view that we should use multiple rather than single research paradigms. These research paradigms might range from the "gold standard" of experimental, quasi-experimental, and multiple-baseline research methods endorsed by the National Reading Panel (2000; see also Luckner, Sebald, Cooney, Young, &Muir, 2005/2006) to correlational studies, case studies based on narrative inquiry, and studies using interpretive, historical, ethnographic, observational, and naturalistic frameworks. Nonetheless, we heed the commentary of Allen et al. (2014):

No doubt, there are multiple routes to the same end, but scientifically, this is quite unsatisfactory as an explanation. As researchers, we want to know the universal that might give rise to the mastery of reading for individuals with quite different sensory and language experiences, for it is very clear that deaf individuals with these varied experiences can and do master the ability to read. (p. 355)

Using the QSH as an umbrella, we hope that the findings of this special issue of the Annals will capture both the common ground and the differences in researchers' views about the d/Dhh reader. As we compile these insights related to the QSH, researchers can continue to collect empirical observations of d/Dhh students during the reading process, form hypotheses, and revise these hypotheses on the basis of research findings.

Our initial plan was to position the articles in alternating order to reflect support of or opposition to the QSH. However, upon reading the articles, we found that such a division did not capture the intent of the authors: More contributors believe that d/Dhh students follow the QSH trajectory. But even though they comment on the similarities of reading development for d/Dhh and hearing students, thereby supporting the QSH, the researchers also describe qualitative differences in specific instructional strategies used by d/Dhh students compared to hearing students, particularly those who are signing d/Dhh bilinguals. Here we agree with Mayer and Trezek (2014), who point out that the QSH may still hold true for students who use different strategies because the task of comprehending the English language in print does not change whether they sign, use oral methods, or do both. While the development may be similar to that of hearing children, however, researchers such as McQuarrie and Parrila (2014) argue that mapping orthography to phonology "may entail fundamentally different mapping units and strategies that are maximally effective for different learners" (p. 379). In other words, d/Dhh readers can use the visual phonology of ASL to map signs to print, as well as other strategies related to other ASL/English bilingual strategies in which they go directly to the English print using their knowledge of ASL, including ASL handshapes, as well as fingerspelling. This view, however, has its detractors. Indeed, ASL is not English but a fundamentally differently structured language occurring in a different modality. So what does ASL have to do with reading? We take up this question below.

In regard to word processing strategies, Allen et al. (2014), McQuarrie and Parrila (2014), and Andrews et al. (2015) counterargue, saying that, indeed, ASL has lots to do with reading English. For example, d/Dhh children can segment the sign stream in a similar fashion to hearing children's segmentation of the speech stream; further, this segmentation ability carries over to the cognitive processes involved in segmenting written language in reading and writing English.

In the same boat, but oceans apart, LaSasso and Crain (2015) and Mayer and Trezek (2014) argue that d/Dhh readers need access to a visual, clear, and consistent phonemic representation of English as found in speechreading, articulatory feedback, Cued Speech, or Visual Phonics, because, after all, these systems visually represent the auditorily based phonology system of English, which is closer to the schoolroom goal of getting children to read English. However, both groups of researchers believe that reading for d/Dhh children follows the same developmental trajectory as it does for hearing children. In our summary of the work of the

nine research teams, we lay out the common ground as well as the differences so Annals readers can arrive at their own conclusions.

But first, we would like to clear the fog about terminology. Our nine research teams present different definitions of reading based on their research goals. Another difference we found in our reading is that the researchers use the term phonology to represent the structure of two different languages-ASL and English. We talk about terminology below, then present summaries of the articles with their pro or con position on the QSH, followed by our conclusions and direc- tions for teacher training, research, and policymaking.

Terminological Considerations

Edmund Burke Huey, in his book The Psychology and Pedagogy of Reading (1916), began a conversation about the definition of reading. He wrote that real reading "begins only with the child's getting the meaning from the whole sentences" (p. 317). Huey recommended picture books such as the Illustrated Primer, by Sarah Fuller (1888), which was used at the Horace Mann School for the Deaf. Fuller was an early educator who wrote the first reading primer for d/Dhh children used in both deaf and hearing schools. Her pioneering primer for d/Dhh students started with illustrations matched with sight words. The child was instructed to look at a picture, say the word, then sound out the word. Later in the book, children were instructed to read sentences matched with pictures, and later answer questions from short paragraphs illustrated by a single picture. Fuller's part-to-whole sequence and view of reading acquisition, from mapping from pictures to print to learning a set of sight words, to later segmenting words into speech syllables and then into phonemes, was to be documented scientifically in studies of reading acquisition decades later. The findings of many of these studies are reflected in the work of our nine research teams.

Reading

Support for the QSH can be seen in our nine teams and their definitions of reading. (See Table 1 for a summary of definitions of reading provided by the teams.) Depending on their research goals, they define reading as simple alphabet knowledge; perception and eye movements; or in terms of broader language processes encompassing vocabulary, fluency, phonemic awareness, reading comprehension, background knowledge, and sociocultural knowledge. Mayer and Trezek (2014) introduce the term phonological sensitivity and make a distinction between (a) phonological awareness learned in the broad context of implicitly learning the phonology of language along with its other aspects and (b) the use of phonology when the teacher explicitly teaches a child how to use phonology and phonemic skills to decode words. LaSasso and Crain (2015) conceptualize the process of reading as one in which the reader is asking questions of the text, and make reference to Goodman (1967), who characterized reading as a "psycholinguistic guessing game."

Phonology

Support for the QSH has also been suggested on the basis of studies of children learning to read through the application of auditory English-based phonology by means of speechreading, the articulation loop, Visual Phonics, or Cued Speech (Easterbrooks et al., 2015; LaSasso &Crain, 2015; Mayer &Trezek, 2014; Twitchell et al., 2015; Wang &Williams, 2014), as well as visual sign phonology using ASL, fingerspelling, and writing with signing d/Dhh bilingual children (Allen et al., 2014; Andrews et al., 2015; McQuarrie &Parrila, 2014).

As a reading theory, the QSH has been strongly linked to phonology, whether it is a sound-based English phonology (Easterbrooks et al., 2015; LaSasso &Crain, 2014; Mayer &Trezek, 2014; Wang &Williams, 2014) or a visual sign phonology (Allen et al., 2014; Andrews et al., 2015). But the QSH encompasses much more. It entails other aspects of language such as semantics (vocabulary knowledge), syntax, pragmatics, and morphology. Understanding the linguistic structure of English sentences has been a tool for reading teachers working with d/Dhh children. For example, Stephen Quigley and his associates used Chomsky's theory of transformational grammar to provide the field with linguistic analyses of English syntax and showed how d/Dhh students had difficulty reading nine specific syntax structures. His and his colleagues' work resulted in empirical studies, language materials, and reading materials related to reading and English syntax (see reviews of

Quigley's work in Paul, 2009; Paul &Wang, 2012).

More recently, the English structure of sound-based or auditory phonology has gained attention in deaf education research in reading. This effect has been strengthened by the findings of the National Reading Panel (2000), with its emphasis on the explicit teaching of phonemic awareness and phonics skills. Later reading achievement has been linked to these sound-based instructional factors. Studies with d/Dhh children have also emphasized the auditory phonology of English (Easterbrooks et al., 2015; LaSasso &Crain, 2015; Mayer &Trezek, 2014; Wang &Andrews, 2014; Wang &Williams, 2014). Arguing against these studies' conclusions, other researchers have explored sign phonology, or what is now called visual sign phonology (Allen et al., 2014; see also reviews of studies in Andrews et al., 2015).

The common ground is that phonology is important to the reading process. Both sound-based English phonology and visual sign phonology deal with segmenting the speech stream or segmenting the sign stream; these segmentation skills are believed to be critical to early reading because they allow the brain and its memory processes to store more words, as well as to activate the reading process. But there are differences, too, between the phonology of English and the phonology of ASL, so we compare them below and relate them to how they apply to the QSH and the understanding of how d/Dhh children learn to read.

Sound-Based or Auditorily Based English Phonology

Phonology, broadly and linguistically defined, is the study of the smallest contrastive unit of language. In spoken language, these contrastive units are sounds (Valli, Lucas, Mulrooney, &Villanueva, 2011). Phonological awareness is an umbrella term that encompasses a variety of sound-related skills, such as understanding that words are made up of sounds, and that words can be segmented into larger sound chunks called syllables; identifying the beginning and end of sounds in syllables; and seeing larger words in small words, for example, be in between (Vacca et al., 2012). Phonological awareness provides the foundation for the teaching strategy of phonics so that the child can "crack the code" and understand the alphabetic principle that sounds and print are connected. One aspect of phonological awareness is phonemic awareness,, which deals with the units of phonemes or sounds and how the child can substitute phonemes in words to change the meaning (e.g., bat, cat). Phonemic awareness skills include the ability to identify rhyme and alliteration, and add, delete, blend, and segment phonemes. While the terms phonological awareness and phonemic awareness are often used interchangeably, they are very different (Vacca et al., 2012).

To compensate for the d/Dhh child's inability to hear the complete speech stream in order to segment it, educators and researchers have suggested the use of speechreading, the articulatory loop, Visual Phonics, or Cued Speech. These are tools to represent the speech stream visually and tactilely to the d/Dhh child through mouth movements, hand cues, and movements positioned near the face. These visual and tactile tools do not represent the speech stream to the d/Dhh child in exactly the same modality a hearing child experiences when hearing the speech stream, and there has been some research examining this functional equivalent aspect (McQuarrie &Parrila, 2009). But as the studies in the present issue of the Annals show, there have been reading gains made by children, both profoundly and severely deaf, who have been able to learn the phonemes of English for reading purposes through direct instruction using the tools of Visual Phonics or Cued Speech.

Such visual and tactile tools are used in countries besides the United States, as well as with other written scripts. For example, Jones (2013) interviewed and observed teachers in China who used pinyin, a written symbol system that uses the Roman alphabet to visually represent the sounds of spoken Chinese. Pinyin symbols are used with d/Dhh children, as well as hand movements, to visually demonstrate the four tones of spoken Chinese. Also, in Taiwan, reading teachers of d/Dhh children use a similar learning tool, zhuyin fuhao, a system of phonetic notation that visually represents the sounds of Chinese (H. Liu, Andrews, &C. Liu, 2014). Mainland Chinese d/Dhh children and Taiwanese d/Dhh children learn to use these systems of visual symbols to assist them in learning the spoken Chinese to map to the Chinese morphosyllabic script or the Chinese characters. Some d/Dhh children are also introduced to Chinese Sign Language or Taiwanese Sign Language

so that they can map its meaning to the morphosyllabic script of Chinese characters. This leads us to the definition of visual phonology.

Visual Sign Phonology

In this two-part special issue of the Annals, the term ASL phonology (or the alternatives visually based ASL phonology or visual sign phonology) is found in three of the articles: Allen et al., 2014; Andrews et al., 2015; and McQuarrie &Parrila, 2014. The work of Brentari (1990, 1998, 2011) in ASL phonology has provided it a theoretical base and elaboration.

In her doctoral dissertation, Bailes (1998) provided the field with early thinking about the connection between ASL phonology and reading. In the dissertation, a classroom ethnographic study, Bailes reported finding that teachers used ASL handshapes and ASL handshape stories as a bridge to the acquisition of English vocabulary. The ASL phonology-to-reading concept was found in seven other dissertations by deaf reading researchers, which included research on the use of ASL handshape stories (Gietz, 2013), the reading of passages in ASL to build the ability to read English passages (Kuntze, 2000), and the use of ASL literature with young children to build literacy in both ASL and English (Byrne, 2013), particularly to develop emergent literacy (Harris, 2011; Herbold, 2008; Snodden, 2012). Further, the concept of visual sign phonology is related to reading as it is found in studies on teaching children to use ASL glossing and ASL-betics, a written symbol system discussed by Cripps (2008). These written notation systems of ASL are taught to children to enable them to learn how to decode ASL prior to learning how to decode or segment English through fingerspelling and writing. What exactly is visual sign phonology? What does it have to do with reading English, a language system that is fundamentally different from ASL in form, structure, and modality?

First described by William C. Stokoe (I960), a professor of English who was fascinated by the ASL all around him at Gallaudet College, where he had gone to teach Chaucer to deaf students, an ASL sign has three parts, or parameters: dez (hand configuration), tab (location), andsig (movement). These are the phonemes of ASL, although Stokoe used the terms chereme for phonemes and cherology for phonology. Later, linguistics showed that Stokoe was describing the phonological structure or the sublexical organization of signs. Linguists then substituted the term phonemes for cheremes. As mentioned above, used in linguistic science, the word phonemes mean distinctive features, or the sublexical-or smallest-linguistic units, and this conceptualization applies to the structure of ASL as well as to spoken languages. By understanding phonology, the language user segments the sign stream into individual signs. ASL organizes its elements in space and movement, either at the same time or in a sequence (Valli et al., 2011). To Stokoe's paramenters, other linguists added movement and nonmanual signals (Valli et al., 2011). Like English, ASL has phonological processes wherein handshapes of signs are blended, assimilated, and combined to form movements and holds, just as spoken-English segments blend and assimilate consonants and vowels. For example, the word cat is made up of three phonemes, /k ae t/, as designated through use of the International Phonetic Alphabet. As an ASL sign, CAT can be segmented as handshape (F), orientation (palm left), location (cheek), and movement (brush index finger and thumb back toward ear twice). (See reviews of linguists' work on ASL in Valli et al., 2011.)

In their work related to emergent readers and d/Dhh children, Allen et al. (2014) have gone further than Stokoe's initial description of ASL phonology as the part of the sublexical description of signs: Allen and his colleagues have included the prosodic, suprasegmental structure of signs and signed sentences. Fingerspelling is also included in this definition. Fingerspelling is considered by some linguists to represent 26 different signs that when combined or blended can be assimilated into the handshape of the next sign, thus altering its shape (Valli et al., 2011). Allen et al. also consider the orthographic patterns of letters to be part of their definition of visual sign phonology. They argue that visual sign phonology gives children usable insights into the internal structure of signs that may, in turn, provide them with the ability to map phonological units of sign into print during early emergent literacy learning, particularly alphabet letter writing and letter shape recognition.

What both sound-based phonology of English and visual sign phonology have in common is that they both deal

with segmenting the stream of language, whether it be the sound stream or the sign stream or even the sequencing and patterning of written language. Pattern recognition of the smallest units of language is a skill all language learners must learn, whether these units be auditory sounds, sounds that are represented visually, or sounds that are represented visually and tactilely through speechreading, articulatory feedback, Visual Phonics, Cued Speech hand cues and mouth movements, signs, fingerspelling, or written letters.

Easterbrooks et al. (2015) define their view of fingerspelling as a type of visual phonological representation that is different from the traditional definition of ASL phonology, which includes the parameters of handshape, location, palm orientation, movement, and nonmanual signals. Taking a different perspective, Allen et al. (2014) propose an expanded definition of what they call visual sign phonology to include fingerspelling, which encompasses its rhythmic patterns and lexicalization processes. Indeed, Valli et al. (2011) cite Battison (1978), who first classified fingerspelling as a part of the morphology of ASL, or as a way that ASL creates new signs by representing the symbols of written English with ASL signs. Thus, according to Battison, fingerspelling is made up of 26 different signs, and when they are combined they go through phonological and lexicalization processes. Easterbrooks et al. (2015) allude to these processes when they discuss how consonant clusters (bl, si, cl, str) or other common affixes (-tion, -ness, pre-) can be produced as smooth, coarticulated sequences, not distinct letters as in the case of neutral fingerspelling that matches a letter to a frozen ASL fingerspelled handshape.

With the terminology defined, in the next section we summarize the nine papers.

A Synopsis of the Articles

Wang &Andrews: Perspectives on the QSH

In a descriptive essay, in defining the QSH we write that

the essence of the QSH is that, generally speaking, the English language and reading development of all students, regardless of hearing status, is qualitatively or developmentally similar, whereas some students who are d/Dhh might demonstrate a quantitative delay when compared with their typically developing hearing peers. (Wang &Andrews, 2014, pp. 320-321)

Further, we state that the QSH supports the use of interventions based on the individual needs of the child and that multiple epistemologies and research paradigms should undergird intervention studies. We highlight three issues that must be taken into consideration when reading interventions are designed:

1. Readers who are d/Dhh form a heterogeneous group with diverse biological, home environmental, and schooling backgrounds.
2. Not all young d/Dhh readers are members of a clearly defined linguistic-cultural minority group. However, many of them grow up to be bilingual adults who employ both ASL and English for everyday uses, and this insight may be useful in the design of early reading interventions.
3. The act of reading is a complex, social-cognitive phenomenon, and establishing ecological validity in research intervention studies continues to be a challenge but a necessity. Ecological validity refers to research findings that can be applied to real classrooms or home situations.

With this descriptive essay, we position the QSH as a starting point for investigating reading and d/Dhh students in this two-part special issue of the Annals.

Wang &Williams: MetaAnalyses of Reading Research

Also QSH supporters, Wang and Williams (2014) systematically analyze both qualitative and quantitative metaanalyses on reading research with PreK-12 students. The authors reviewed 11 qualitative and 39 quantitative meta-analyses with typically developing hearing students, special education hearing students (including English Language Learners), and students who were d/Dhh. On the basis of this review, Wang and Williams contend that the QSH is defensible and is supported by interventions proven effective for hearing English Language Learners, hearing students in special education, and d/Dhh students who have been tested with rigorous research methodology that meets the "gold standard" of the National Reading Panel (2000). The

authors recommend that five areas of d/Dhh children's reading development be addressed further: alphabetics, fluency, vocabulary, morphology, and text comprehension.

Allen et al.: Early Visual Language Exposure and Emergent Literacy

Allen et al. (2014) examined the impact of early visual language exposure on early literacy, cognition, and social adjustment, using a cross-sequential (or accelerated longitudinal) method with young d/Dhh children, ages 3 to 7 years who had severe to profound hearing losses (> 60 dB) and no additional disabilities (N = 251). The researchers report four major findings:

1. When fingerspelling skill was controlled for, ASL showed an independent effect on letter knowledge. ASL skill was interpreted as being derived from a visually based phonological process that transfers to the learning of letters and an orthographically based system of sublexical units that can combine to form words and can occur independently of letter-sound knowledge and fingerspelling, even though fingerspelling contributes to this ability.

2. A strong correlation was found between the development of ASL and emergent literacy, which suggests that language development is supported through bilingual experiences. Further, a strong correlation was found between the variables of language and socialization, suggesting that early language development contributes to the socialization of young d/Dhh children, in forms such as reduced impulsivity and greater social adaptability.

3. A strong relationship between visual language and the ability to sustain visual attention was found. That is, children could manage their visual attention, which leads to growing language skills that they can use to adapt to social situations in preschool.

4. Using a parent rating scale, the researchers found that d/Dhh children with deaf parents who signed were rated as more likely to demonstrate reading and language skills, but that performance of d/Dhh children of hearing parents varied as parental sign skills varied.

On the basis of these four findings, Allen et al. conclude that the QSH is valid if it is presented as "modality independent" (p. 355).

Mayer &Trezek: Reexamining the Role of Phonology

In a critical essay, Mayer and Trezek (2014) contend that all d/Dhh readers must develop understanding of the alphabetic principle, which is the relationship between phonemes and graphemes. They argue that even severely and profoundly deaf readers can develop knowledge of the alphabetic principle with little or no reliance on audition or speech but instead use other modalities, such as Cued Speech or a visual-tactile tool such as Visual Phonics that stands in for phonological representations, in order to master sound-symbol correspondences.

Mayer and Trezek (2014) assert that the same knowledge and skills used in learning to read by hearing children apply to the acquisition of reading by d/Dhh students, even though d/Dhh students may use qualitatively different instructional strategies. The authors believe that d/Dhh children need knowledge of the English language, which includes its phonology, semantics, morphology, syntax, and discourse, as well as code-based skills, which are acquired through instructional emphasis on phonological awareness and systematic and explicit instruction in phonemic awareness. Mayer and Trezek cite evidence that d/Dhh students who use a phonological code in working memory tend to be better readers. They critique the studies that show that d/Dhh children can bypass English auditorily based phonology in learning to read, arguing that there is insufficient empirical evidence to support the claim that English auditorily based phonology does not play a role in reading for d/Dhh individuals. They emphasize that d/Dhh children need to learn about the phonological aspects of English both as a part of their implicit language acquisition process and in building as a foundation for benefiting from explicit code-emphasis instruction in the alphabetic principle. The authors suggest the use of the overarching category of phonological sensitivity, which includes both phonological and phonemic awareness. They caution the profession against "the communication disputes that continue to dog our field" (p. 367) and encourage researchers to refocus their energies and examine phonological sensitivity at two junctures: (a)

during the overall English-language acquisition process and (b) during the explicit teaching of the code with phonics instruction.

Mayer and Trezek (2014) conclude that the QSH is tenable and that interventions designed for hearing students, including those that explicitly teach English auditorily based phonological awareness skills, should be used in deaf education. They also suggest the need for longitudinal studies examining phonological sensitivity as well as studies that focus on the reciprocal relationship between reading and writing.

McQuarrie &Parrila: Literacy and Linguistic Development

McQuarrie and Parrila (2014) suggest that students need to set up high-quality word representations, as doing so is one of the cognitive precursors that facilitate the acquisition of language, whether it be spoken, signed, or written. They present findings from two studies that contrast the nature of bilingual profoundly deaf children's phonological representations derived from a spoken language and from a signed language using the framework of "functional equivalence" as outlined in their work. They argue that a signed language phonological system appears best suited to establishing the "functional" representational base for reading acquisition of bilingual deaf learners. Making reference to Grainger (2008), they assert that "cracking the orthographic code" is possible for bilingual deaf skilled readers, though these readers do this in a different way than hearing children. As such, McQuarrie and Parrila provide evidence that supports a QDH in reading processes for bilingual deaf readers. Their view is centered on the relationships between signed language phonology, lexical restructuring, and written-language literacy acquisition. They claim that there are still fundamental skills underlying reading that are necessary for all learners to master (QSH), but that their work seeks to recontextualize what those skills represent and how they might be optimally mastered by bilingual deaf learners when they process visual written-word recognition.

Interestingly, McQuarrie and Parrila (2014) caution researchers not to focus on whether or not signed language forms can directly map to orthography. Indeed, they claim that a more productive line of questioning would focus on how dual languages interact in the mental lexicon of bilingual deaf readers, as well as how signed language transfers during the reading process. They further argue that longitudinal studies are necessary to address these questions if there is to be an understanding of how sign language phonological processing skills influence the pace and course of reading development for bilingual deaf readers. McQuarrie and Parrila believe that there are some aspects of reading that d/Dhh readers share with hearing readers-a position that supports the QSH.

Andrews et al.: A Historical Review of Dissertation Research by Deaf Scholars

The second part of our two-part special Annals issue starts with a historical review covering a 40-year time span. Using a qualitative interpretive analysis approach, Andrews et al. (2015) examined 31 dissertations as primary texts, reviewing them for themes over five time periods. A thematic trend was found, from communication methodology in the 1970s (first time period), to English reading skills in the 1980s (second time period) to ASL/English bilingualism to support the acquisition of English literacy during the third, fourth and fifth periods (1990-2013). The authors found that the majority of the dissertations by deaf scholars used a combination of qualitatively similar and qualitatively different epistemologies in their research. Although this was not always explicitly stated, they found that five of the dissertations supported the QSH. These studies used only standard epistemologies, and only the students' proficiency or activ- ities in one language, English, were described when reading was discussed. The authors interpreted the remainder 26 dissertations as studies that used both standard and deaf epistemologies. As a result, the interpretive analyses support the hypothesis that the majority of the deaf scholars would support the position that reading for d/Dhh students is both qualitatively similar and qualitatively different.

Strategies that the dissertation authors described as visual and qualitatively different from those used with hearing children included learning to read English generally through sign bilingualism. As such, the strategies included translating texts, using metalinguistic awareness with their two languages, having teachers fluent in

ASL or Chinese Sign Language sign whole stories to the children, bypassing the auditory phonological code to support the learning of English, using cognitive engagement or cognitive discourse in ASL to develop English reading skills, using fingerspelling in mediating between ASL and English, using sign writing and ASL gloss as intermediate steps to English, and using ASL literature as a foundation for reading English literature. The use of ASL phonology through handshape stories was also found to bridge the learning of English sight words.

In most of the dissertations from the period 1990-2013, the deaf scholars supported the use of the translation strategy to go from sign or fingerspelling to print as an ostensible difference from hearing students' process of learning to read. Indeed, Gallimore (2000) noted that finger scanning under a line of print signaled to d/Dhh children that a translation was about to occur. However, while Bailes (1998) supported translation as a reading strategy, she suggested that there were "questions about the efficacy of translating between English and ASL and vice versa . . . studies are needed to determine where, indeed, the utilization of translation fits into the reading process . . . indeed, translation is a complicated process" (p. 294). More strongly than Bailes, Cripps (2008) challenged the notion of translation as a reading skill. Instead, he suggested that current bilingual techniques, such as translation and codeswitching, do not give d/Dhh readers the skill to become independent readers on their own. Cripps said that translation was not a reading skill, but a more complex cognitive task. Cripps supported the use of ASL glossing and sign writing, by which a d/Dhh child could be taught 32 grapheme symbols that would enable that child to read in ASL writing. "For young deaf students, sign gloss and sign writing become an 'intermediate writing system' for deaf students to directly access ASL" (Andrews et al., 2015, p. 415). But another deaf scholar, Kuntze (2004), stated, on the other hand, that an intermediate system such as sign writing or a manual code of English was not necessary, but that d/Dhh readers could go directly from comprehending ASL to reading academic English print if they were exposed to inferential ASL or high levels of ASL discourse-a concept aligned to what Cummins called "CALP," for "Cognitive Academic Language Proficiency" (Cummins, 1979); Harris (2011) called the concept "extended discourse."

Easterbrooks et al.: Reading- What, How, for Whom?

Easterbrooks et al. (2015) are in the midst of a 2-year study of how d/Dhh children in grades K-2 learn to read. Using a confirmatory factor analysis, the researchers aim to test the hypothesis that their conceptual model describes the nature of reading skills of d/Dhh children in those grades. Their model is based on four distinct skills that may impede or support d/Dhh children's literacy growth: phonological, linguistic, literacy, and cognitive abilities. Considered separately from their reading model, fingerspelling, according to the authors, offers an alternative phonological strategy for reading words, unrelated to spoken phonology but related to fingerspelling phonology and orthographic regularities. The purpose of their study is to investigate child-by-instruction interactions to determine whether some d/Dhh children learn differently from others and to examine the relationship between effective instruction and various child characteristics. In addition, the researchers are investigating whether fingerspelling can be an alternative to spoken phonology processing so that d/Dhh children can use fingerspelling to make graphemephoneme connections. The research team has administered tests to more than 300 d/Dhh children and conducted classroom observations with d/Dhh children in grades K-2. The researchers hypothesize that approaches to reading for d/Dhh children depend on their functional hearing and that reading interventions may depend on whether d/Dhh children can use spoken English as a foundation for reading, while those without functional hearing may use signs as the foundation for English reading and may require visually accessible skills such as fingerspelling in order to learn to read.

Easterbrooks et al. (2015) support the QSH in the overall design of their conceptual model, as they believe that similar constructs for learning to read exist for both d/Dhh and hearing children. However, they also hypothesize that there will be qualitative differences in the nature of these constructs for deaf children who do not have functional hearing and who use sign language. They further hypothesize the d/Dhh children who acquire sign language develop two visually based phonological systems-one related to sign and the other related to fingerspelling. Further, the authors argue that since fingerspelling maps directly onto print, it may be an

alternative to spoken phonology of d/Dhh children without functional hearing. Furthermore, there are qualitative differences in the skills that underlie language, in that d/Dhh children who are acquiring sign languages such as ASL as well as a conceptually based English sign system might integrate different language skills as they learn to read.

'Bvitchell et al.: Effects of SES on Bilinguals' Literacy Development

Switching the focus from the classroom to the home, Twitchell et al. (2015) used a mixed-effects linear modeling design to investigate the impact of SES and LI (ASL) language skills on L2 (English) literacy achievement. The authors examined the test scores of 212 deaf children and adults ranging in age from 6 to 26 years, with a hearing loss of 85 dB or greater in the better ear. The goals of the study were to consider (a) if SES predicts L2 (English) reading ability in signing bilinguals, (b) if LI proficiency (ASL) predicts L2 (English) reading ability in signing bilingual readers, (c) if both factors affect L2 (English) reading ability, and (d) if ASL and SES are correlated with each other.

Twitchell et al. found that ASL\English bilinguals' reading proficiency benefits from higher levels of home SES. The authors suggest that high-SES parents are able to provide more opportunities for their children in the home, are role models for reading, and use mediation strategies that are closely aligned with the level of their child's language. The authors interpret the results of their study to encourage teachers and researchers to take SES into account as an important factor influencing parent-child interactions. Further, they recommend that studies be designed to see how parents teach their children mediation literacy interactions in the home. ASL and SES were positively correlated in the most proficient readers in this study, but not for readers with low proficiency in reading. Further, the researchers found that SES directly affects ASL\English bilinguals' L2 literary success, and that the effect is independent of and additive to the benefits of LI proficiency in ASL. Since SES and ASL proficiency were not correlated for deaf signing bilinguals, the authors say that it is critical that a range of sensitive, complex linguistic and social interactions be explored that can account for the way these factors contribute to the process of acquiring language and literacy during childhood bilingualism.

LaSasso &Crain: Nature Versus Nurture

Home environment is also an important variable in the review and critique by LaSasso and Crain (2015). They argue that reading is more a function of environmental factors, that is, the richness of a child's early linguistic input during critical language years as well as the richness of language during school years, and less a function of hearing loss. The authors contend that each d/Dhh child needs to be provided with clear, complete visual access to English as it is transmitted at the phoneme level, through the use of Cued Speech. They cite research showing that d/Dhh children need to have opportunities to interact with fluent English-language users and need to develop background knowledge in English to "reduce readers' questions while reading" (p. 448).

It is the view of LaSasso and Crain (2015) that reading for d/Dhh children has been narrowly defined, with the definition focusing only on the alphabetic principle, which can be qualitatively similar or qualitatively different for d/Dhh readers compared to hearing readers. The issue is the access to English, and the authors believe such access is best provided by Cued Speech, which is used with more than 60 languages and dialects. Cued Speech uses a tactile-kinesthetic rather than an auditory feedback system, and d/Dhh children can use this to "decode" words even if they cannot speak or hear these words. LaSasso and Crain further argue that Cued Speech is more advantageous than morphemeic sign systems of English, which represent English grammar. They support the QSH if d/Dhh readers have sufficient background knowledge, English-language skills, phonics skills, and other decoding skills to ask questions about an English text regardless of their hearing status. This finding contrasts with that of Easterbrooks et al. (2015) that functional hearing is the factor that affects whether d/Dhh students use qualitatively similar or qualitatively different strategies.

Conclusions

We invited scholars in the area of reading to contribute to a two-part special issue of the Annals on literacy and d/Dhh students. To that end, nine teams of scholars accepted our invitation and contributed an article. We

asked the contributors to address three questions: (a) For the d/Dhh student, is reading qualitatively similar to the reading process of the hearing student? (b) Is it, rather, qualitatively different? (c) Or is it both qualitatively similar and qualitatively different?

In the main, to our surprise all nine teams recognized that many aspects of the reading acquisition process of d/Dhh children are similar to those of hearing children, and that the QSH is tenable if it is "modality independent," to use the wording of Allen et al. (2014). Two of the articles, by McQuarrie and Parrila (2014) and Andrews et al. (2015), include the finding that both the QSH and the QDH are supported in the research. Common ground and differences are further described below:

* All agree that d/Dhh students vary widely in both their English and signing proficiencies.
* The definition of reading ranges from a narrow view of alphabetics or word learning to broader views encompassing background knowledge, prior experience, and knowledge of language (oral and/or ASL), and including SES and other cultural factors. The teams emphasize different aspects of the overall reading process, depending on their specific research goals.
* All support phonology as necessary but not sufficient for reading, whether it be an auditory or sound-based English phonology or a visual sign phonology, as in the case with signing deaf bilinguals.
* All use different research paradigms derived from the "gold standard" enunciated by the National Reading Panel (2000). These include critical essays, experimental designs, longitudinal designs, historical reviews (including classroom ethnography), teacher interviews, classroom observations, and correlational designs.
* All support the view that early, consistent, and high-quality language input is needed either in oral English or through a sign language (either Signed English or ASL) for the child to build a foundation of language in order to learn to read English.
* The outcomes of five of the teams (Easterbrooks et al., 2015; LaSasso &Crain, 2015; Mayer &Trezek, 2014; Wang &Andrews, 2014; Wang &Williams, 2014) focused on the process of reading the English language where only the structure of the English language was considered in reading instruction.
* The outcomes of three teams (Allen et al., 2014; McQuarrie &Parrila, 2014; Twitchell et al., 2015) focused on the reader understanding and using the structure of the English language, but also on using the linguistic structure of ASL as in ASL handshapes in working with signing deaf bilinguals.
* One team (Andrews et al., 2015), which reviewed 31 dissertations of deaf scholars, found 5 dissertation studies that focused on the English language only in reading instruction, and 26 that related the reading of English to understanding and being exposed to the linguistic structures of both English and ASL.
* All believe that young d/Dhh readers are chunking letters into patterns and are becoming expert letter-pattern recognizers. But there are different viewpoints on how these readers do this. Some say d/Dhh readers can recognize patterns in letters by chunking them using auditorily based English phonology (through speechreading, the articulation loop, Visual Phonics, or Cued Speech) to map onto English words. Others believe that d/Dhh readers can chunk and recognize patterns by using similar sign handshapes or other parameters of sign, or may use fingerspelling to map onto English printed words. Some think they may use both at different times in their reading lives.
* There are differences among the scholars in regard to the use of translation and transliteration of text from sign to print. Do these complex, cognitive processes constitute reading? If so, how are these processes different from decoding English print?
* One study reviewed by Andrews et al. (2015), Cripps (2008), suggested that sign writing be used as an intermediary step to learning to decode printed English; other deaf scholars in the review expressed the belief that reading does not require an intermediary step and that d/Dhh readers can go directly from ASL to English.
* Differences in views among the teams can be seen in the types of mediation or bridging strategies used by teachers to teach reading. Some of the teams recommend only English-based mediation strategies such as speechreading, articulatory feedback, Visual Phonics, Signed English, or Cued Speech, while other teams

recommend ASL/ English bilingual strategies to teach reading.

* Differences in acknowledging the role of fingerspelling are seen among the teams: Some express the view that fingerspelling has its own internal structure and rhythmic patterns that differ from simply using fingerspelling to associate a fingerspelled handshape with a letter, an idea suggested by four research teams (Allen et al., 2014; see review of studies in Andrews et al., 2015, in a review of 31 dissertations by deaf scholars; Easterbrooks et al., 2015; McQuarrie &Parrila, 2014). This expanded view of fingerspelling is believed to play a role in English-word learning because fingerspelled words become lexicalized into signs (Easterbrooks et al., 2015).

Revisiting the QSH: Future Directions

In I960, William Stokoe stated that ASL was qualitatively similar to the English language in the sense that it had five aspects found in all languages: phonology, morphology, semantics, syntax, and pragmatics. Yet his research, his students' work, and that of later linguists documented the qualitative differences between spoken and sign languages, such as how the phonology of ASL was expressed differently from the phonology of English. That is, the sign could be broken into sublexical units (phonemes or cheremes) as handshape, movement, and location, or the three parameters; grammar was also found on the face in facial expressions, eyebrow raises, cheek puffs, etc. We have now reached a similar state in the field of reading.

As the writers in this two-part Annals special issue have expressed, the reading acquisition process for d/Dhh children is qualitatively similar (per the QSH) to that of typically developing hearing children in that they must pass the same developmental milestones, such as emergent literacy. This point is underscored by the large number of hearing researchers these authors cite in their definitions of reading, as shown in Table 1: Children who are d/Dhh are seen as learning how to identify words through some cognitive-perceptual process of pattern recognition such as visual/orthographic patterns (i.e., print), visual/orthographic/tactile patterns through fingerspelling, visual speechreading, visual/auditory articulatory feedback, visual/tactileAinesthetic movements such as in systems like Cued Speech or Visual Phonics, or visual/patterns applied to analysis of the segmentation of the sign stream. Reading acquisition unfolds and develops throughout the young reader's schooling. The young reader segments new words in the sign or speech stream, figuring out new vocabulary, figuring out the syntax, making inferences from texts. The d/Dhh reader may be taught different mapping tools such as speechreading, articulatory feedback, Cued Speech, or Visual Phonics. These tools may be used alone. Alternatively, these mapping tools may be used along with signing and fingerspelling. Just as the Chinese d/Dhh reader has pinyin and the Taiwanese d/Dhh reader has zhuyin fuhao, the American d/Dhh reader has visual and visual/tactile tools as well to study the sequencing of letters into blends, syllables, and words. Alternatively, they may use the orthographic tool of fingerspelling to segment words.

Implications for Teacher Education

The findings of the nine research teams provided us with ideas for teacher education. We think that both preservice and in-service teachers would benefit from course work and workshops on the concept of reading, as well as course work on methodologies in reading research. Additionally, they would benefit from course work on studies of reading acquisition by hearing children and studies on reading acquisition of d/Dhh children, particularly those from bilingual deaf families. In keeping with the QSH, they would also find it useful to learn about the concept of reading as defined by different reading scholars in reading education with diverse views on how reading develops. Learning how to critically read the professional journals on reading and apply the information to the deaf education classroom would also be helpful. Those interested in research could study the various research paradigms used in reading research and construct studies applying these paradigms. Course work in the linguistics of English and the linguistics of ASL for teachers would also be useful, as would research by deaf scholars-teachers could gain insights from "emic" or insiders' view of the reading process for d/Dhh individuals. Course work on the advantages of Visual Phonics and Cued Speech are also in order. Those teachers who work with signing bilingual deaf students would benefit from these suggestions, as well as from

course work in ASL\English bilingual methodology.

Implications for Future Research and for Policymakers

Additional research is needed to address the role of auditory or soundbased phonology and the role of visual sign phonology in word recognition and reading comprehension. The role of functional hearing is addressed in several of the articles as being important (Easterbrooks et al., 2015) or not important (LaSasso &Crain, 2015). Clearly, more studies are needed to examine how d/Dhh children can use their residual hearing to learn about reading, as well as further research on how d/Dhh children with more hearing can also benefit from ASL\English bilingual strategies, as found by Grushkin (1996) in his dissertation, an ethnographic study of four hard of hearing youths.

Investigating the spelling errors in d/Dhh children's writing may provide further insights into their use of auditorily based phonology and visual sign phonology. Easterbrooks et al. (2015), in citing the work of Allman (2002), found that the invented spellings of d/Dhh children who use sign language had patterns of errors that differed qualitatively from those of hearing children relative to vowel locations in words. Allman suggested that children coded visual aspects of fingerspelling, speechreading, and signing to words rather than matching sounds to words. Further, Mayer and Trezek (2014) comment on the reciprocal nature of reading and writing, so work on writing may provide insights into the d/Dhh child's reading processes.

While none of our nine research teams presented articles related to neuroscience and the bilingual brain, work by Kovelman, Shalinsky, Berens, and Petitto (2014) suggests that bimodal and bilingual experiences can shape the brain during the reading process; these findings need to be translated to reading pedagogy for the reading teacher and reading researchers. Further, we had no articles on electronic reading with e-books or iPads, and nothing on online reading along with text message reading. Clearly, these are exciting areas for new research, as these technologies can present signing and print simultaneously as well as provide tools for dictionaries, thesauri, and encyclopedias.

Our field clearly needs to move beyond the study of reading at the word level. While understanding how word learning develops is important, there are other aspects that need attention, such as how the reading of whole books unfolds during shared book reading (an area that could benefit from developmental studies) and the social-cultural and constructivist views of the reader during the reading process (Mason et al., 1992; Taylor, Anderson, Au, &Raphael, 2000).

Policymakers need to publicize the importance of family home reading programs and the necessity for early access to language, whether it be oral, signing or both. As more d/Dhh children receive cochlear implants, bimodal practices are being developed; this area is in need of more reading-related research. Parents and professionals need to be continually educated to be aware that speech training and increased child speech production does not guarantee language and literacy development.

We would like to conclude by encouraging the formation of deaf/ hearing collaborative teams in studying reading, as the field can benefit from the "emic" and "etic" perspectives on the reading processes of d/Dhh students. As Jones (2013) and Kuntze (2004) point out, deaf researchers can assist the profession in reframing and testing hypotheses about how d/Dhh children learn and develop reading skills. Such insights can assist us in helping d/Dhh students develop the mechanics of reading and writing by recognizing letter patterns and then mapping these letter patterns onto meaning-as well as in developing the "literate imagination" invoked by Lois Lowry and Seth Lerer.

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