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Listening Comprehension, Oral Expression, Reading Comprehension, and Written Expression: Related Yet Unique Language Systems in Grades 1, 3, 5, and 7

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Abstract

Age-normed tests of Listening Comprehension, Oral Expression, Reading Comprehension, and Written Expression were administered in grades 1 (*n*=128), 3, and 5 or 3 (*n*=113), 5, and 7. Confirmatory factor analyses compared one- and four- factor models at each grade level and supported a four- factor model of Language by Ear, Mouth, Eye, and Hand. Multiple regressions identified which of the three other language skills explained unique variance in each of the four language skill outcomes and provided additional evidence that language is not a single skill. Individuals' ipsative scores (amount that the standard score for age on each language measure deviated from individual's mean for all four measures) showed that 25% to 30% of individuals showed relative strengths or weaknesses (+ or − 1 SD) in specific language skills, but only 7% were stable across grades 3 and 5. Findings are discussed in reference to (a) theoretical implications for idea comprehension and expression via language by ear, mouth, eye, and hand, and (b) educational applications of observed developmental and individual differences for general, special, and gifted education.

Language by Ear, Mouth, Eye and Hand

Language develops as it interacts with its "end organs," which are its contact with the external world (Eliot, 1999). The end organs include (a) the sensory systems that receive incoming information from the environment, such as ears while listening to aural language and eyes while reading written language; and (b) the motor systems that operate upon the physical and social environment during literacy learning, such as mouth while producing oral language to express ideas and hand while producing written language to express ideas. Because language may develop in unique ways depending on its history of interacting with the physical and social environment through the end organs or the sensory feedback from motor output[1], it is possible that four separate but interacting functional language systems are constructed. Alternatively, it is possible that a single language system underlies listening, talking, reading, and writing, and this system learns to communicate with and operate all end organs equally well. Yet another possibility is that four language systems develop but learn

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[1]Each of the motor systems also receives sensory feedback, creating sensory-motor links (e.g. touch sensation for mouth and hand movements and visual feedback for writing letters, words, and text) that may also contribute to the formation of the developing language systems (see Berninger & Richards, 2008; Richards, Berninger, & Fayol, 2009).

to communicate so well they are generally highly interrelated but sometimes distinct. The current study was designed to evaluate which possibility may best characterize listening comprehension, oral expression, reading comprehension, and written expression in early childhood (grade 1), middle childhood (grades 3 and 5), and early adolescence (grade 7). We tested the *a priori* hypothesis that these four language skills draw on both unique and common processes. That is, we predicted four language systems, which, even though they may often work collaboratively in concert, may be separable and in some ways unique.

In generating this hypothesis, we drew on three lines of existing evidence. First, for normal written language development, reading and writing share at most about 50% of the processes in common (Shanahan, 2004, 2006). Second, few children with developmental language disorder have pervasive primary language disorder or developmental aphasia. Far more common is selective language impairment (SLI) in which specific language functions are impaired and other language functions are spared (Butler & Silliman, 2002;Wallach & Butler, 1994). Third, listening, speaking, reading, and writing draw on both common and unique brain structures and functions (Berninger & Richards, 2002) and cannot be differentiated solely by their end organs (Liberman, 1999).

This research is timely because both writing and oral language may be relatively neglected at a time when considerable attention is focused on improving reading skills. First, we consider why writing may not be given as much attention as reading in some educational settings. According to Fitzgerald and Shanahan (2000), much research on writing has focused on the reading-writing relationship, for example, regarding the complementary roles of readers and writers in achieving rhetorical goals, the integration of reading and writing for academic tasks, and the shared knowledge and cognitive processes. The research on shared processes has focused mainly on meta-knowledge about reading and writing, domain-specific background knowledge, common text attributes (phonological, orthographic, morphological, syntactic, and text), and procedural knowledge for engaging in reading and writing (Fitzgerald & Shanahan). Fitzgerald and Shanahan (2000) offered three explanations for why writing has often been separated from reading within American education and relatively neglected in language and literacy research: (a) reading is more valued than writing, (b) separate professional organizations exist for reading and writing, and (c) belief that writing acquisition depends on first acquiring reading skills. The latter is not supported by research but nonetheless the belief persists. In reality, kindergarten children can express ideas in writing even without explicit reading instruction (Berninger, 2009; Berninger & Chanquoy, 2009), and kindergarten writing contributes to kindergarten reading (Berninger, 2009) and first grade reading (Shatil, Share, & Levin, 2000).

Although the onset of oral language precedes the onset of written language, a growing body of research shows that oral language continues to develop concurrently with written language (reading and writing) during early and middle childhood (e.g., Beers, 2008; Nagy, Berninger, & Abbott, 2006; Seml, Wiig, & Secord, 2003). Research also shows that listening, speaking, reading, and writing emerge in overlapping, cascading waves rather than strict sequential phases and develop in interacting fashion throughout early and middle childhood (Berninger, 2000). Over forty years ago Harrell (1957) conducted one of the first longitudinal studies showing that oral language is related to writing and others followed (reviewed by Shanahan, 2006). Educators cannot assume that all students enter school with adequate listening and speaking skills. Although teachers employ all four language modalities in instruction, for example, through oral discussions (oral expression), lectures (listening comprehension), writing assignments (written expression), and reading assignments (reading comprehension), they are less likely to be aware of the importance of taking individual differences among learners in these four language skills into account in planning instruction and assessing response to instruction. At both the pre-service and in-

service levels teachers may not receive adequate preparation in recognizing and responding to individual differences among students in oral language development (listening comprehension or oral expression). For these many reasons, in the current study we investigated written expression and its relationship to reading comprehension and two oral language systems (listening comprehension and oral expression) in grades 1 to 7.

In comparing language skills, we focused on comprehension and expression of ideas for two reasons. First, word-level decoding or spelling skills, which are clearly important for learning to translate heard or viewed words into spoken or written words, have been studied extensively (e.g., Liberman, Shankweiler, & Liberman, 1989; Perfetti, 1985; Stanovich & Siegel, 1994; Vellutino, Tumner, Jaccard, & Chen, 2007). Relatively less research attention has been devoted in recent years to high-level comprehension and expression skills in literacy learning. Second, currently in education high-stakes standards and testing emphasize thinking rather than rote learning and communication of one's thoughts without relying on multiple choice tests (e.g., Jenkins, Johnson, & Hileman, 2004).

To summarize, the specific aim of the research was to test competing hypotheses about language. The *a priori* hypothesis was that four language skills involving high-level idea comprehension or idea expression are separate, though interacting, and become integrated. A related hypothesis was that each of the four language skills may be developed to varying levels within and among individual students and these intra- and inter- individual differences may change across development and schooling. Support for these related hypotheses would indicate that the interrelationships among the language skills and any interindividual and intraindividual differences in language within and across grade levels could be theoretically significant and educationally relevant. On the other hand, the alternative hypothesis was that all language skills involving high-level idea comprehension or idea expression draw on a single underlying language system developed to the same level regardless of history of interacting with the world through modality-specific sensory input (ear or eye) or motor output (mouth or hand). We next consider methodological considerations in testing these competing hypotheses.

Studying Individual Differences within and among Children across Language Skills at Discrete Times in Development

Psychometric tools—A psychometric test is constructed so that items discriminate among children of the same age and total scores can be expressed as standard scores for age. A psychometric test that includes measures of the four language skills of interest, all of which are normed on the same national standardization sample, is ideally suited for testing the hypotheses just discussed for two reasons. First, because children at the same grade level often vary over a year in age, standard scores for age can be used to describe, despite variability in age within a grade, the level to which each individual's four language skills of interest are developed compared to peers of the same age. Second, the scale used for describing an individual relative to an age peer (mean 100 and standard deviation 15) remains the same across schooling. Thus, test results can be used to assess whether a student shows relative decrease, stability, or improvement in the specific language skills across schooling. For all these reasons, a psychometric test, which has listening comprehension, oral expression, reading comprehension, and written expression subtests, all normed for age peers in the same national sample, was used to test the competing hypotheses.

Converging methods—Because results may depend on research methods used and consistent results across multiple methods can lend converging validity to a research program (Shadish, Cook, & Campbell, 2002), we used three methodological approaches in analyzing the psychometric test results to test the competing hypotheses at each grade level

(1, 3, 5, and 7). The first set of analyses applied confirmatory factor analysis to investigate possible latent variables underlying the four language skills. Such information is not available in test manuals for psychometric tests, which provide norms for single tests; however, understanding the factor structure among tests and how it may change across schooling is relevant to test interpretation and educational application of test results. The goal of these initial analyses was not to study how each language skill changes across development independent of its relationship with the other language skills at the same grade level. Nor was it to study longitudinal influences of single language skills on each other across the grades. Rather the goal was to evaluate whether the confirmatory factor analyses showed that a four-factor model fit better than a one-factor model for the four language measures, which would support the tested *a priori* hypothesis. If we found that a one-factor model provided an equally good fit the alternative hypothesis would be supported.

The second set of analyses applied multiple regression to examine how individual differences in three of the language skills might contribute to learning a fourth language skill. Separate regressions were performed for each of the four language skills as the outcome. Of interest was not only the amount of variance explained but also which language skill(s) might contribute uniquely, depending on which language skill was being predicted. Finding changing patterns of interrelationships in which language skills predicted which language outcomes uniquely at specific grade levels would support the tested *a priori* hypothesis for distinctive language skills. Finding that none of the predictors explained unique variance in the outcome over and beyond their shared covariance with each other would support the competing hypothesis.

The third method was to construct language profiles for each individual based on the four language skills. Each individual's score on each language measure was compared to the individual's mean score across the four language measures. The resulting ipsatized scores were used to identify individuals for whom one or more of the four language skills differed by one standard deviation or more from their own mean. Finding a sizable number of individuals with differences that large, especially if such dissocations from one's own mean are stable across grades, would support the tested *a priori* hypothesis that language skills are related but also distinct. Failure to find differences that large on ipsative scores would support the competing hypothesis that the four assessed language skills reflect a single underlying language domain.

Thus, we drew upon approaches in both disciplines of scientific psychology—that which is variable-centered based on group designs and that which is person-centered based on individual subject designs (Cronbach, 1957). The first and second set of analyses used group designs and the third used repeated measures designs followed up by individual profile analyses. Although the second used a variable-centered analysis, results can be interpreted in reference to individual differences between students on specific language skills predicting individual differences between students in a fourth language skill. The third set of analyses yield results that could be interpreted in reference to individual differences within each student to identify that individual's relative strengths and weaknesses. We reasoned that collectively the three methods would provide more insight than either alone about the issue of whether (a) separate but related language systems are constructed depending on which end organs interacted with the environment and may receive feedback from it[1] during literacy development across the grade levels studied; or (b) a single system, no matter which sensory or motor organ interacted with or received feedback from the environment, underlies language ability. Of interest was whether the different methods for ruling between the competing hypotheses would generate comparable results and thus support the same conclusion about the hypotheses tested.

Method

Participants

Recruitment—Letters of invitation for a longitudinal study beginning the next year were sent out to all parents of kindergarten and second grade children in each of 51 elementary schools in a large urban school system in the Pacific Northwest of the United States. This school system serves a diverse student population in terms of SES and racial and ethnic groups. Interested parents contacted the research coordinator who answered parents' questions about the study, which was approved by the institutional review board and conducted in accordance with ethical guidelines of the American Psychological Association for research with human participants. If children met inclusion criteria (no indicators in developmental or medical history of brain injury or disease, genetic or neurodevelopmental disorder, or primary emotional disturbance) and parents were willing to participate, then parental informed consent and child assent were obtained. Although some of the children were from bilingual homes, all participating children were proficient in English, which was typically their first or primary language even if other languages were spoken at home. Thus, the sample was neither a sample of convenience, for example, attending the same school, nor a referred sample with clinical disorders.

Few children in a cohort were from the same grade level in the same school in the large urban district, which was located near the university where the annual testing took place. District policy supported diversity in classroom teaching practices in written language during the time this research was in progress and past research studies in the district confirm diversity in classroom teaching practices (e.g. Berninger et al., 2002; Berninger, Dunn, Lin, & Shimada, 2004; Berninger, Yates, Cartwright, Rutberg, Remy, & Abbott 1992; Berninger, Cartwright, Yates, Swanson, & Abbott, 1994). Thus, it is unlikely that results are confounded with systematic effects from instructional programs.

Two cohorts were studied, one beginning in grade 1 at time of initial formal literacy instruction and one beginning in grade 3 when literacy skills are further along in their development. The rationale was that conclusions about oral or written language development can be affected by where in the developmental process relationships among the four functional language systems are investigated. Table 1 reports the gender distribution and mean age for participants in each grade in each year of the five-year longitudinal study by cohort.

The sample was also representative of the school system and the Pacific Rim region from which it was drawn in ethnic and racial diversity and level of education (see next section). This region continues to see increases in its average test scores on high stakes test and the National Educational Assessment of Progress (NAEP). Although many parents were college educated, parent questionnaires and conversations with research personnel indicated some parents were the first generation in their families to attend or graduate from college.

Although children participated annually for five years, the oral language measures that were critical for the research aims of this study were given only in years 1, 3, and 5 when cohort 1 was in grades 1, 3, and 5 and cohort 2 was in grades 3, 5, or 7. Thus, only those grade levels are included in the current study.

Younger cohort—These children were initially enrolled in grade 1 (n=128) and attrition rate was low across Grade 3 (n=122) and Grade 5 (n=114). This cohort reflected diversity in self-reported ethnicity (one-third were not European Americans) and parents' level of education (one indicator of socioeconomic background) in grade 1: European American (64.8%), Asian-American (23.4%), African-American (6.3%), Hispanic (1.6%), Native

American (1.6%), and other (2.3%). About 10% of the parents had less than a high school education or graduated from high school (7% mothers and 12.5% fathers). Nearly 10% of the parents had more than a high school education but less than a college education (11.7% mothers and 7.8% fathers). Over 40% of the parents had an undergraduate education (45.3% mothers and 39.8% fathers). About 33% of the parents had completed graduate degrees (33.6% mothers and 32.0% fathers). Information on parental level of education was missing for 2.4% of the mothers and 7.9% of the fathers in the younger cohort.

Older cohort—These children were initially enrolled in grade 3 (n=113) and attrition rate was also low across Grade 5 (n=106) and Grade 7 (n=99). This cohort also reflected diversity in self-reported ethnicity (one-third not European American) and parents' level of education at the beginning of the study: European American (65.5%), Asian-American (21.2%), African-American (9.7%), Hispanic (0.9%), and other (2.7%). About 7% of the parents had less than a high school education or graduated from high school (7.1% mothers and 7.1% fathers). Over 12% of the parents had more than a high school education but less than a college education (11.5% mothers and 14.2% fathers). Over 40% of the parents had an undergraduate education (50.4% mothers and 36.3% fathers). Nearly 33% of the parents had completed graduate degrees (30.1% mothers and 35.4% fathers). Information on parental level of education was missing for 0.9% of the mothers and 7.2% of the fathers in the older cohort.

Procedures

For this study of individual differences across oral and written language that contrast in input and output modes, we used four psychometric tests of language, which are subtests on The *Wechsler Individual Achievement Test, Second Edition (WIAT II)* (Psychological Corporation, 2001). This test battery widely used in schools in North America had been constructed so that items differentiated among individuals, each language subtest was normed on the same national standardization sample, and composite scores on tasks in subtests can be transformed into a standard score for age (M=100, SD=15) that can be compared across the four language measures (see Introduction). Although all individuals start at the same starting point for grade, not all individuals complete the same items; items administered depend on establishing a basal of consistently correct responding and a ceiling of consistently incorrect responding, which are based on patterns of student performance on national standardization samples and criteria for establishing them is specified in the administration manual.

At the time the five-year study commenced, psychometric measures of written expression available assessed only sentence-level composing or assessed composing about a picture, which tended in our experience to elicit description of pictured ideas rather than expression of one's own ideas. A measure of extended expository writing was needed for our research aims. Also, other available psychometric tests at that time did not include measures of listening comprehension, oral expression, reading comprehension, and written expression normed on the same national standardization sample that yielded standard scores for age that could be compared across subtests. Another criterion that entered into the selection of the WIAT II was that Written Expression tasks were organized by a levels-of-language framework that included word fluency, sentence combining, and essay composing. Prior research had shown that each of these levels contributed to the translation of ideas into written compositions at the text level (e.g., Whitaker, Berninger, Johnston, & Swanson, 1994).

Each of the tasks for listening comprehension, oral expression, reading comprehension, and written expression was administered individually in a quiet room by highly trained and

supervised graduate students. Tests were given in the same order each year (writing during the first block, reading during the second block, and oral language during the third block) so that differences across years could not be attributed to differences in order of administration. Testers were instructed to give the children rest and snack breaks at scheduled times throughout the session to avoid fatigue and refresh them for tasks to follow. For example, during the rest breaks participants were interviewed for their attitudes toward writing (Graham, Berninger, & Fan, 2007), which the children found engaging and were refreshed to complete new tasks. Items on each task were administered according to criteria in the test manual for establishing starting points and for establishing basals and ceilings. Reliabilities are reported for the age range of the children in the research sample. The oral language measures were given only in the first, third, and fifth year of the study. Thus, in this study, analyses were conducted for year 1 (cohort 1, grade 1; cohort 2, grade 3), year 3 (cohort 1, grade 3; cohort 2, grade 5), and year 5 (cohort 1, grade 5; cohort 2, grade 7).

Measures

WIAT II Listening Comprehension—This subtest is based on three tasks: Sentence Comprehension, Receptive Vocabulary, and Expressive Vocabulary. For Sentence Comprehension, the students were asked to select a picture that matched a word or sentence spoken by the examiner. For Receptive Vocabulary, they were asked to point to one of four pictures that portrayed the meaning of a word pronounced by the examiner. For Expressive Vocabulary, they were asked to generate one word that matched a verbal description of a concept provided by the examiner. These tasks, which were used as the indicators of the latent factor for Listening Comprehension in the confirmatory factor analyses, assess the student's ability to listen and demonstrate understanding of language at the word and sentence levels with minimal expressive language—pointing or using single words. Raw scores were used as the indicators of the factor in the confirmatory factor analyses; these yield the same results as *z*-scores for grade based on the research sample. Standard scores for age, which are available in the test manual only for summary scores based on all three tasks, were used in the regression and ipsative analyses. The reliability coefficients for the Listening Comprehension tasks range between .78 and .82.

WIAT II Oral Expression—The subtest is also based on three tasks: Oral Word Fluency, Giving Directions, and Visual Passage Retell, For the Oral Word Fluency, the child generates orally and quickly words in a designated semantic category. For Giving Directions, the child describes orally a sequence of steps necessary to complete a familiar action or task designated by the examiner. For Visual Passage Retell, the child looks at a series of cartoon pictures and tells a story about them, which is scored for detail and accuracy in depicting the content of the pictures in sequence. These tasks, which were used as the indicators of the latent factor for Oral Expression in the confirmatory factor analyses, assess the student's ability to use language and speech to express ideas orally in words, sentences, and text. Raw scores were used as the indicators of the factor in the confirmatory factor analyses; these yield the same results as *z*-scores for grade based on the research sample. Standard scores for age, which are available in the test manual only for summary scores based on all three tasks, were used in the regression and ipsative analyses. The reliability coefficients for the Oral Expression tasks range from .83 to .89.

WIAT II Reading Comprehension—This subtest requires that the child read passages and then answer literal or inferential questions the examiner poses about each passage. Basal and ceiling rules for item sets for grade (revised directions after initial publication) were used to administer these tasks. Reading Comprehension had only one task that yielded a score based on the total item sets for grade that exhibited considerable range in the untransformed scores as well as in transformed standard scores for age at a particular grade

level. Raw scores were not used because a standard score for age was provided in the test manual. The reliability coefficients for Reading Comprehension range from .94 to .96.

WIAT II Written Expression—This subtest includes three written expression tasks. For Written Word fluency, the child generates in writing as many words as possible within a given time limit for a designated category; word fluency may play a role in the word choice process (selecting words to express ideas) while composing. For Sentence Combining, the child combines two or three separate sentences to create one new sentence with the same meaning. For Paragraph Writing, the child writes about a prompt within a given time limit. These tasks, which were used as the indicators of the latent factor for Written Expression in the confirmatory factor analyses, assess the student's ability to use words, sentences, and text to express ideas in written language. Raw scores were used as the indicators of the factor in the confirmatory factor analyses; these yield the same results as *z*-scores for grade based on the research sample.

Standard scores for age, which are available in the test manual only for summary scores based on all three tasks, were used in the regression and ipsative analyses. The standard score for age was based in grades 3, 5, and 7 on all three subtests (Written Word Fluency, Sentence Combining, and Paragraph Writing) because, according to the test manual, the extended writing prompt is administered only in grades 3 and above. However, based on prior research evidence (Berninger, 2009; Berninger & Chanquoy, 2009), for current research purposes, we gave the same extended writing prompt for third graders to the first graders and used the scoring criteria in the test manual to obtain a raw score that was used as an indicator for the latent factor analyses in grade 1 for the confirmatory factor analyses; the raw scores yield the same results as the *z*-scores for grade based on the research sample. For the multiple regressions and ipsative scores, which required standard scores for age, per the instructions in the test manual, in first grade we did not use the essay writing task but rather used only the alphabet writing, word fluency, and sentence combining tasks, but in grades 3, 5, and 7, we used the word fluency, sentence combining, and extended writing prompt tasks. The reliability coefficients for the three Written Expression tasks range from .81 to .87.

Confirmatory Factor Analysis

First, EQS 6.1 (Bentler, 2006) was used for Confirmatory Factory Analysis (CFA) to evaluate the one-factor and four-factor measurement models in each cohort at each grade level, based on the covariance matrix of the WIAT II indicators of the latent factors, which for the four-factor model are the separate tasks described in the Measures section for each subtest. In the CFA of the one- factor model, all tasks were assumed to be indicators of one-Factor. We fit both the one-factor and the four-factor models to the covariance matrix for the younger cohort at grades 1, 3, and 5, and for the older cohort at grades 3, 5, and 7. We also compared the factor loadings and covariances among factors for both cohorts at grade 3 and grade 5 using multiple group CFA

Multiple Regressions for Different Language Outcomes

Four separate multiple regressions were performed, one for each of the four language measures as the dependent variable: Listening Comprehension, Oral Expression, Reading Comprehension, and Written Expression. For each of these regressions, the other three language measures served as independent measures, that is, predictor variables. We evaluated whether the overall regression was significant and percent variance that it explained in the outcome measure and whether each predictor variable explained unique variance in the outcome over and beyond its shared variance with the other predictors. Standard scores for age were entered into all the multiple regression analyses.

Ipsative Approach for Language Profiles

For the first step, we initially computed each child's mean standard score for age across the four language subtests as an index of the child's average language development: WIAT II Listening Comprehension, Oral Expression, Reading Comprehension, and Written Expression. Next, we calculated the difference between each child's norm-referenced standard score for age for each language subtest and his or her mean across the four language subtests. The resulting *ipsative* scores reflected the relative magnitude of deviation of a standard score for age on a specific language system from the individual's mean (with a + sign for ipsative scores above the child's mean language score or − sign for ipsative scores below the child's mean language score). Children who did not vary much across the four language systems had deviation scores near or at zero. Finally, repeated measures ANOVA was used to evaluate main effects for language (four levels), and grade (time—3 grade levels). Separate analyses were performed for each cohort (Cohort 1 in grades 1, 3, and 5 and Cohort 1 in grades 3, 5, and 7). The dependent measure was the ipsative scores.

For the second step, we evaluated whether these *ipsative* scores calculated in the first step represented *relative strengths* (+1 SD or greater above the child's mean not the population mean) or *relative weaknesses* (- 1 SD or more below the child's mean not the population mean). For only those who exhibited relative strengths and weaknesses within individual language profiles, we evaluated whether these remained the same from third to fifth grade. Cohorts 1 and 2 were pooled across these grade levels for this analysis. Average standard error of measurement (SEM) for each subtest (6.73 Listening Comprehension; 5.55 Oral Expression; 3.38 for Reading Comprehension; and 5.71 for Written Expression) in the WIAT II Administration Manual was used to establish the criterion of a difference of 1 SD (15 standard score points) or more (exceeds 2 SEM units) as the criterion for relative strength or weakness.

Results

Descriptive Statistics

Table 2 summarizes the means and standard deviations for standard scores for age for each WIAT II subtest in each cohort in each year of the study. Although many of the mean standard scores for age were above the population mean, the standard deviation showed normal variation (range in standard scores), that is, individual differences within each measure at each grade level. Even though many parents were college educated, their children exhibited normal variation in the development of the four target language systems. Please note in interpreting descriptive statistics, standard scores for age are expected to show variation within a grade level, because they are based on tests constructed to measure individual differences compared to age peers within a grade level. It is expected that raw scores will improve across ages or grades, but unless the child's relative performance compared to age peers shows relative gains, the standard scores for age will not change across age.

Confirmatory Factor Analysis (CFA)

First, we consider the loadings of indicators on their respective factors in the CFA analyses and their implications for the measurement model. Second, we report results of the confirmatory factor analyses and discuss model fit.

Loadings on latent factors in CFA—All measures are statistically significant indicators of their respective latent factors, with the exception of word fluency in grade 7 which approached statistical significance (see significant *z*-scores in Tables 5 and 6). Under model fit we discuss the significance of this finding. Because there was only one indicator on the

reading comprehension factor it was identified as the reference indicator by fixing its loading to 1.

Model fit—In the younger cohort, the four-factor model fit the covariance matrix of the 9 tasks significantly better than did the one-factor model at first grade ($\Delta\chi^2(5)= 11.13$, $p <.05$), third grade ($\Delta\chi^2(5)=15.76$, $p <.01$), and fifth grade ($\Delta\chi^2(5)=17.73$, $p <.005$). Model fit statistics for the four-factor models are shown in Table 5. Fit statistics for the one-factor model for the younger cohort were: first grade ($\chi^2(27)=40.43$, p< .05; CFI=.92; RMSEA=. 06); third grade ($\chi^2(27)=44.67$, p< .025; CFI=.91; RMSEA=.06); and fifth grade ($\chi^2(27)=54.54$, p< .001; CFI=.84; RMSEA=.10)

For the older cohort, the four-factor model fit the covariance matrix of the tasks significantly better than did the one-factor model at third grade ($\Delta\chi^2(5)= 11.11$, $p <.05$), fifth grade ($\Delta\chi^2(5)= 19.31$, $p <.005$), and seventh grade ($\Delta\chi^2(4)= 20.25$, $p <.05$). Model fit statistics for the four-factor models are shown in Table 6. Fit statistics for the one-factor model for the older cohort were: third grade ($\chi^2(27)=45.18$, p< .025; CFI=.89; RMSEA=.08); fifth grade ($\chi^2(27)=43.38$, p< .025; CFI=.89; RMSEA=.08); and seventh grade ($\chi^2(19)=48.04$, p< .005; CFI=.79; RMSEA=.10). The difference in the df in the 7th grade is because the Listening Comprehension factor was modeled only on the receptive/expressive vocabulary task because the sentence comprehension task had significant restriction of range that produced a non-positive definite covariance matrix.

A multiple group four-factor CFA compared the results for the third grade in the younger cohort and the third grade in the older cohort. A multiple group four-factor CFA also compared the results for the fifth grade in the younger cohort and the fifth grade in the older cohort. In each of these two analyses, first a multiple group unconstrained four-factor model was fit to the two covariance matrices. Then a multiple group constrained four-factor model (with all factor loadings and covariances among the factors constrained equal in the 2 cohorts) was fit to the 2 covariance matrices. There was no significant difference in the overall fit of the constrained and unconstrained models at third grade ($\Delta\chi^2(14)= 17.17$, $p >.$ 05) or at fifth grade ($\Delta\chi^2(14)= 9.08$, $p >.05$), and Lagrangian Multiplier tests indicated than no single df constraint was significant.

Therefore, to conserve journal space, we report only the results for the first grade and third grade in the younger cohort in Tables 3 and 5 and for the fifth grade and seventh grade in the older cohort in Tables 4 and 6. Results for the fifth grade in the younger cohort and at third grade in the older cohort are available from the second author.

Table 3 shows the means, standard deviations and correlations for the younger cohort among the indicators of the Listening Comprehension, Oral Expression, Reading Comprehension, and Written Expression factors in first grade and third grade. Table 4 shows the same information for the older cohort in fifth and seventh grade. These correlations between indicators on the same and different factors ranged from low to moderate. The covariances and variances are based on the deviation scores (Bentler, 2006). Table 5 shows the results for the four-factor CFAs for Grade 1 and Grade 3 in the younger cohort. Table 6 shows the results for the four-factor CFAs for Grade 5 and Grade 7 in the older cohort.

The standardized covariances (correlations among the four factors) are also shown (e.g. listening comprehension ↔ oral expression) in Tables 5 and 6 and are all statistically significant. Standardized covariances in Tables 5 and 6 indicate that the four factors are positively correlated in first grade (range .63 to .80), third grade (range .43 to .70), fifth grade (range .48 to .84) and seventh grade (range .28 to 60). These covariances at all grade levels reflect the shared processes or common core in language. However, the factors are not

perfectly correlated and thus have unshared unique variance as well as the shared covariance. This interpretation is also supported by the results that the four-factor model fit significantly better than the one-factor model for each grade level for each cohort. The important conclusion is that these converging results provide strong and consistent evidence in support of the *a priori* hypothesis that four language systems defined by mode for interacting with the environment are separable even though they may often function in concert.

Summary—CFA results from the overlapping grades across cohorts (third and fifth) were consistent across cohorts and grades. The results for the fifth grade (younger cohort) and third grade (older cohort) are available from the second author, but the others are reported in Tables 3 to 6. For both cohorts at all grade levels the four-factor model provided a better fit than the one-factor model.

Multiple Regressions

All regressions were significant. Of interest was whether some language skills contributed uniquely to the fourth language skill beyond their shared variance with three other skills. Evidence of such unique contributions would support the hypothesis that the language skills were related but also distinct from each other. If none of the language skills contributed uniquely to another, that result would support the competing hypothesis.

Predicting reading comprehension—In grades 3 and 5 (cohort 1) and grade 3 (cohort 2) each of the three language skills contributed uniquely to reading comprehension. In grade 5 (cohort 2) listening comprehension and, in grade 7 (cohort 2), listening comprehension and written expression contributed uniquely. See Table 7. Thus, consistently across grades and cohorts listening comprehension explained unique variance in reading comprehension, but except for grade 5 in cohort 2, that was not the only language skill that explained unique variance in reading comprehension. Written composition contributed uniquely to reading comprehension in grades 3 (both cohorts), 5 (cohort 1), and 7 (cohort 2).

Predicting written expression—In grade 1 (cohort 1) reading comprehension contributed uniquely to written expression. In grade 3 (cohort 1) each of the three predictor language skills contributed uniquely to written expression. In grade 5 (cohorts 1 and 2) reading comprehension contributed uniquely. In grade 7 (cohort 2) oral expression and reading comprehension contributed uniquely. See Table 8. Thus, consistently across grades and cohorts, reading comprehension explained unique variance in written expression, but in grade 3 and 7 so did oral expression.

Predicting listening comprehension—Consistently at each grade level in each cohort, reading comprehension contributed uniquely to listening comprehension. Thus, the interrelationship between listening comprehension and reading comprehension is bidirectional and idea comprehension to some degree is explained uniquely by modality of input. In grade 3 (cohorts 1 and 2) and grade 5 (cohort 2), written expression also contributed uniquely. See Table 9.

Predicting oral expression—In cohort 1 at all grade levels and grade 3 (cohort 2) reading comprehension contributed uniquely to oral expression. In grade 3 (cohort 1) and grade 7 (cohort 2) written expression also contributed uniquely. See Table 10. Of interest, listening comprehension never explained unique variance in oral expression, but at least one written written language skill did in grades 1 to 7. Thus, a common language component may underlie listening comprehension and oral expression despite differences in modality of interaction with the world (ears for input or mouths for output) and the common distinction

between receptive and expressive oral language. At the same time, each of these aural/oral language skills contributed uniquely to a specific written language skill but the other did not.

Summary—In general, regression results were most consistent with the tested *a priori* hypothesis that language skills are related yet unique. Bidirectional interrelationships were observed for listening comprehension and reading comprehension in which they contributed unique variance to each other in grades 1, 3, 5, and 7. For the most part (cohort 2 in grade 5 was the only exception), the relationship between reading comprehension and written expression was bidirectional in grades 3, 5, and 7; in grade 1 the relationship was asymmetrical, with reading comprehension contributing uniquely to written expression but not vice versa. Receptive and expressive oral language (listening comprehension and oral expression) may draw on a common language core more than receptive and expressive written language (reading comprehension and written expression) because neither oral language skill ever contributed uniquely to the other. However, results that follow show that these oral language skills are not completely identical and do also show evidence of being distinct.

Ipsative Scores and Language Profiles

Ipsative scores—Table 11 shows the means and standard deviations of the yearly ipsatized standard scores on Listening Comprehension, Oral Expression, Reading Comprehension, and Written Expression for the younger cohort at Grades 1, 3 and 5, and for the older cohort at grade 3, 5, and 7. Patterning of ipsative scores is consistent with fluctuations in level of language skill across development. Table 12 shows the results of the repeated measures ANOVA for these ipsative scores for each language task and three grade levels, analyzed separately for each cohort. Note that this analysis combined the methods of both variable-centered and person-centered approaches—ANOVA group analyses of ipsative individual difference scores. For both cohorts, both Oral Expression and Written Expression had significant time effects, indicating significant change in ipsative scores from grades 1 to 5 (cohort 1) and from grades 3 to 7 (cohort 2). These two language tasks require expression, that is, construction of a response. Results for Listening Comprehension and Reading Comprehension were inconsistent across cohorts (see Table 9), probably because of individual differences that affect receptive language development.

However, ipsative scores for Written Expression consistently differed from the ipsative scores for the other language systems across the grade levels analyzed (see Tables 11 and 12). Although writing was a fluctuating weakness in the younger cohort, with the size of the weakness compared to other language skills sizable in grades 1 and 5 but not 3, in the older cohort, whose grade 3 mean ipsative score was remarkably close to that of the younger cohort in grade 3, the magnitude of the ipsative scores increased steadily from grades 3 to 7. Thus, in this unreferred sample of developing writers, relative weaknesses in writing compared to other language systems were detected as early as grade 1 and generally persisted. See Discussion for reasons these findings cannot be attributed to WIAT II Written Expression being more difficult than the other three language subtests.

Ipsative scores also pointed to strengths. In contrast to Written Expression, Oral Expression showed steady gains in relative strength over time from grades 3 to 7, except for grades 1 to 3 in the younger cohort (Table 12). For the younger cohort, the mean ipsative score was always positive across the grades for Listening Comprehension and Reading Comprehension. For the older cohort, the ipsative scores were never consistently positive, suggesting that developmental fluctuation in ipsative scores from grades 3 to 5 may be normal.

Language profiles—It is important to note that not all individuals showed relative strengths and weaknesses. For the majority of the children from early to middle childhood to early adolescence, the four language systems were generally developed to comparable levels. However, of those who showed fluctuation across their language profiles, 21 (about 8.6% of the total sample) consistently exhibited an uneven pattern in development in their language profile in both third and fifth grade. Of these 21 children, 18 showed the same pattern of relative strength or weakness in one language skill in both third and fifth grade: consistent strength in listening comprehension (*n*= 4), oral expression (*n*=2), reading comprehension (*n*=1), and written expression (*n*=0) or consistent weakness in listening comprehension (*n*= 2), oral expression (*n*= 0), reading comprehension (*n*=1), and written expression (*n*=4). Some showed a stable profile across two language skills: strength in oral expression and weakness in written expression (*n*=2), or strength in listening comprehension and weakness in written expression (*n*=2). Of interest, in this sample of normally developing writers, which displayed normal fluctuation in relative strengths and weaknesses, none of them showed a consistent relative strength in written expression compared to the other language systems.

Discussion

Methodological and Theoretical Significance

First we consider the theoretical significance of the findings for each method applied to test the competing hypotheses with focus on the implications for language development. Then, we consider the consistency of the findings across methods of data analyses and value of applying contrasting methods (person and variable based) in evaluating whether evidence is converging.

Confirmatory factor analysis—The *a piori* hypothesis was confirmed. Consistently across grades and cohorts, the four-factor model for multiple language systems fit better than the one-factor model for a single language system. This finding suggests that although end organ alone (ears, eyes, mouth, and hand) may not explain language development (see Liberman, 1999), functional systems that develop as children listen to language through their ears or eyes and express ideas in language through their mouth or hand may be separable and have distinct characteristics because their unique histories in interacting with the world in contrasting ways create different paths to the higher order language skills in the mind. Each of the four language factors had significant paths, indicating that they were all contributing significantly to the functional language system. The indicators of the factors varied to some extent not only in end organs but also in levels of language in specific tasks employed: words and sentences in Listening Comprehension to words, sentences, and text in Oral Expression, Reading Comprehension, and Written Expression. Results will always depend to some extent on the measures employed. Future research might employ listening comprehension, oral expression, reading comprehension, and written expression tasks carefully matched on all dimensions (including levels of language) except mode of input and output.

Multiple regressions—In general, the multiple regression results support a view of language development in which the four language skills share variance, but also exhibit dynamically changing unique interrelationships among the four language skills across the grade levels. Thus, they also support the tested *a prior*i hypothesis. In addition, the multiple regression analyses provided converging validity for a comprehension system that, to some degree, is affected by modality of interacting with the environment (input via ear during listening or via eye during reading): Reading comprehension explained unique variance in listening comprehension, and listening comprehension explained unique variance in reading

comprehension. If both assessed only a common language core, then one would not expect the observed bidirectional relationships related to explaining unique variance in each other. Although listening comprehension and oral expression both involve oral language (receptive input and expressive output, respectively), they never explained unique variance in each other and thus may draw on a common language core *to a greater extent* than does the written language factor across modes of environmental contact. For the most part, reading comprehension and written expression explained unique variance in the other.

Ipsative analyses—Nevertheless three sets of ipsative findings show that the listening comprehension and oral expression are not completely the same skill or language system. First, from third to fifth grade, profiles of ipsative scores across the four language skills showed that listening comprehension and oral expression sometimes reliably dissociated, which would not happen if they were identical: Two individuals showed a consistent strength in listening comprehension; two showed a significant strength in oral expression; two showed a consistent weakness in listening comprehension; two showed a consistent strength in oral expression and a consistent weakness in written expression (but listening comprehension was neither a strength nor weakness); and two showed a consistent strength in listening comprehension and consistent weakness in written expression (but oral expression was neither a strength nor weakness). Second, as shown in Table 11, the relative ordering of means across grade levels was different for listening comprehension and oral expression in each cohort. Third, as shown in Table 12, for the older cohort, the ipsative scores for listening comprehension did not reliably change over time but those for oral expression did. Thus, listening comprehension and oral expression are not always developed to comparable levels relative to age peers as would be the case if these skills were completely identical.

When variation within each individual's four language systems was examined using ipsative scores comparing an individual to his or her own mean level of language performance relative to age peers, both intra-individual and inter-individual differences were observed at the same grade level. Sometimes these were stable and sometimes they fluctuated across grade levels. For some children (but not the majority), at least one and sometimes more than one language skill was at least one standard deviation above (relative strength) or below (relative weakness) the individual's mean: 25% of the third graders and 30% of the fifth graders. However, only 8.6% of the third graders who exhibited such variation also did so in fifth grade. Even then, sometimes which language skills remained relative strengths or weaknesses changed. Only about 7 % retained the same relative strengths and weaknesses from third to fifth grade in a specific language system defined on the basis of an end organ for communication with the environment. Again, these results confirm the *a priori* hypothesis. If language was a single system, stable dissociations among the four language systems would not be expected. Although some might focus on only a small percentage (7) showing stable patterns of relative strengths and weaknesses, others might find it remarkable that in an unreferred population not selected for at-risk or special education students, that such patterns of uneven language development are observed at all. Clinical experience suggests that the percentage showing dissociations is considerably higher in children with learning disabilities.

Contributions of variable-centered and person-centered analyses—In designing the study, we drew on both variable–centered and person-centered analyses. Variable-centered analyses focus on the relationships between constructs interpreted within a theoretical framework. Person-centered analyses are based on analysis of data for individuals and yield results that can be generalized to conclusions about individual differences between individuals (inter-individual differences) or within individuals (intra-

individual differences). Understanding the role of language in learning may benefit from drawing on both approaches, as this study demonstrates.

On the one hand, the current study focused on how the functional systems for listening comprehension, reading comprehension, oral expression, and written expression might be separable or inseparable. These systems were modeled on basis of high-level expressive or receptive language systems, which require idea expression or idea comprehension that varies by input or output modes, as does most academic learning (e.g., Kintsch, & Van Dijk, 1978; Pressley, & Wharton-MacDonald, 1997). Modeling each of four language systems separately provided a better fitting model than did a single language system in grades 1 to 7.

On the other hand, the current study also used methods of examining how (a) individual differences among children in one language system uniquely predicted individual differences among children in another language system, and (b) individual differences within the same individual across a profile of four language skills. If a general language module alone accounts for language achievement, then one factor should account for the measurement of all language skills, but it did not—a four-factor model best accounted for the four language skills. Likewise, also inconsistent with a single language system, children exhibit both interindividual and intraindividual differences in the four language skills studied.

Research that has previously combined the methods of both scientific disciplines in psychology—variable centered and person centered—has shown normal variation in response to the same instruction in the general education classroom (Berninger & Abbott, 1992) and in individual tutorials for at risk readers and writers (Abbott, Reed, Abbott, & Berninger, 1997). The contributions of the two scientific disciplines are particularly relevant in an era that increasingly seeks one set of homogeneous standards for all students in all states in the United States. Although analyses of variable-centered group data may provide evidence for appropriate high stakes standards, organized within a normal progression of developmental steppingstones in learning to read or write, for children in general, person-centered individual data that documents stable intra-individual differences can be used to modify and tailor those homogenous standards for individuals whose language learning profiles differ.

Converging evidence—Despite the limitations of any one of the methods employed (confirmatory factor analyses, multiple regressions, ipsative analyses, and variable- and person-centered analyses) all provided support for the *a priori* tested hypotheses. Such converging evidence strengthens confidence in the conclusions drawn about the tested hypothesis (Shadish et al., 2002).

Educational Applications

General education—Stable language profiles based on ipsative scores might inform differentiated instruction in the regular classroom. The most stable weaknesses in this sample were in written expression, which was never an area of stable strength. The finding that relative weaknesses were more often observed on Written Expression does not show that WIAT II Written Expression was more difficult than the other three other language subtests. Written Expression was not the only language subtest on which individuals show relative weaknesses. Nor did most individuals show relative weaknesses in Written Expression. Rather, the observed cases of relative weakness in writing show that for some individuals writing is underdeveloped compared to their average across the four language skills on a common scaling metric (mean 100 and standard deviation 15) allowing direct comparison of subtests independent of difficulty of specific items on subtests.

Both stable talents (relative strengths) and stable disabilities (relative weaknesses) were identified in individual students' language profiles and these were identified for both oral and written language. It follows that schools should identify these and nurture or remediate, as appropriate. Although oral discussion is increasingly used in teaching across the curriculum (e.g., Beck & McKeown, 2001, 2007; Reznitskaya, Anderson, McNurlen, Nguyen-Jahiel, Archodidou, & Kim, 2001; Nussbaum, 2002), not all schools have in place systematic programs for identification of which students may need differentiated instruction in the language domain.

Special education—Federal policy in special education (IDEIA, 2004;U.S. Department of Education, 2005) mandates that students with educationally handicapping conditions in listening comprehension and oral and written expression receive free and appropriate education (FAEP). However, in practice more attention is given to learning disabilities involving reading and comparatively little research has been directed to identification and treatment of the learning disabilities involving oral language and writing. Those with learning disabilities in specific oral language *and* written language abilities (OWL LD) and in specific writing abilities (dysgraphia) may be under-identified and under-served (Berninger, 2008; Berninger, O'Donnell, & Holdnack, 2008) as also are those who are both intellectually gifted and learning disabled in writing (Yates, Berninger, & Abbott, 1994).

Children with difficulty learning oral as well as written language require specialized oral and written language instruction (e.g., Scott & Winsor, 2000; Silliman & Scott, 2009). Children may need explicit instruction in how to (a) process teachers' instructional talk; and (b) differentiate the oral register (used in oral language during informal conversation and sometimes in written narratives to portray authenticity of characters' oral expression) and the academic register (used at school in written textbooks and compositions and sometimes instructors's pedagogical talk),. For further discussion of the distinction between the oral and academic register and how children who struggle with academic learning may benefit from explicit instruction in the academic register, see Beers and Nagy (2008, and submitted) and Silliman and Scott (2009).

Children who show stable weaknesses in writing, regardless of whether they qualify for special education services, require individualized instruction to improve written expression, which may include a transcription component focused on handwriting and/or spelling (e.g., Berninger, Winn et al., 2008; Berninger & Wolf, 2009b). Access to effective writing instruction is especially important in an era when high-stakes tests depend greatly on writing skill (Jenkins et al., 2004).

Gifted education—Some of the students in the current study had IQs in the superior or very superior range and qualified for pull-out enrichment or full-time gifted education in their local schools. Increasingly, professionals are recognizing the presence of twice exceptional students in schools who are both gifted and learning disabilities, sometimes across language systems, for example, relative strengths in listening comprehension or oral expression and relative weakness in reading (e.g., fluency) or written expression (Gilger, & Wilksen, 2008). Most schools do not systematically assess students to identify those who may be gifted and talented in oral and/or written expression and might benefit from educational programming that nurtures such talent. Significant strengths (talents) may be specific to oral and/or written expression of ideas rather than all aspects of the curriculum (Berninger & Yates, 1993). Multiple assessment approaches could be employed to identify talents in any of the four language systems by ear, mouth, hand, and/or eye including but not restricted to psychometric tests: Classroom observations documented by audio and written portfolio assessment might identify those with gifts relevant to future careers in oratory (public service and politics), entertainment (stand up comedians or actors and actresses),

journalism or other media of communication, or art (illustrators for written publications) (e.g., Dunn, & Finley, 2008). Programming might include supplementary enrichment instruction, special classroom pullout from general education, accelerated advancement in grade placement, or alternative learning environments to foster language talents in ways that traditional lecture and reading and writing assignments do not.

Limitations

Research is always limited by the measures of relevant constructs available to it. When the first author began her research on language in 1980, no standardized tests of oral language for children older than six were available such as the *Clinical Evaluation of Language Functions (CELF-4)* (Seml et al., 2004) or the WIAT II Listening Comprehension and Oral Expression, both of which can be used to assess oral language skills in children, adolescents, and young adults. When this research began we used the one test instrument that was available for assessing the four language systems in a way that met our research aims. Since then, other tests have been developed and the one we used has been revised. Nevertheless this research contributes toward modeling how one might (a) study listening, speaking, reading, and writing with psychometric test measures of individual differences in a longitudinal design of repeated measurements on the same individual across grade levels, and (b) analyze results so that they can be generalized to both groups and individuals. Future research can extend this work with other tests or assessments (not exclusively psychometric), methodological approaches, and hypotheses tested.

Liberman (1999) cautioned that language cannot be defined solely by its “end organs.” The current research did not address what other factors such as world knowledge or cognitive ability might contribute to the development of the four language systems (listening, speaking, reading, and writing). Future research should explore other factors that may contribute independently or interactively to development of functional language systems.

The current research did not test the hypothesis about the role of language systems defined by end organs until the beginning of formal education in first grade. Future research might initiate such a study during the preschool years during which the reading and writing as well as listening and speaking systems are developing (e.g., Berninger & Chanquoy, 2009). In fact, during the first two years, both sensorimotor knowledge and language are developing and becoming interrelated; the senses and motor systems are the only end organs with direct contact with the world (Eliot (1999). Language may be a complex system, without direct contact with the external world that is needed for internal management of the incoming messages about what is happening in the world, plans for acting on the world via the motor systems, and translating cognitions in unconscious, implicit memory, which has even more indirect contact with the external world, into conscious representations in working memory.

Summary and Conclusions

Some still believe that children learn oral language before they come to school and the purpose of schooling is to teach written language. The current study showed that (a) average standard scores for age in each of the four language skills show relative changes from first to third to fifth to seventh grade (see Table 2); (b) both the Listening Comprehension and Oral Expression Factors were always correlated with the Written Expression Factor from grades 1 to 3 to 5 to 7 (see covariances in Tables 5 and 6); and (c) Listening Comprehension contributed uniquely to Written Expression in grades 3 (both cohorts) and grade 5 (cohort 2), and Oral Expression contributed uniquely in grade 7 (cohort 2) (see Table 8). Thus, oral language may continue to develop during the school years when children learn written language and contributes to learning to write.

When the four separate language systems are well integrated and synchronized, language may be experienced as a unitary construct, much as rain is experienced as unitary wetness rather than as isolated drops. However, renaissance chemists demonstrated that underlying each water drop are millions of molecules with a two-to-one ratio of hydrogen-to-oxygen atoms, which are not visible to the naked eye. Likewise, although on one level, language is experienced as a unitary whole, on another level, language is an invisible, internal, multi-component system with subsystems that mediate interactions between the internal mental world, where thinking occurs, and the external world from which sensory systems receive information during listening or reading and to which motor systems transmit information during oral or written expression. Many children learn to self regulate and navigate within and across the four language systems with relative ease during the great adventure of learning to use language within and across input-output systems to communicate between the internal mental and external social worlds. Others need specialized instruction for relative weaknesses and/or nurturing for their special gifts in one or more language system that supports idea comprehension or expression. Combining knowledge about these four language systems from both scientific disciplines of psychology (Cronbach, 1957) has added value for meeting the needs of both students in general *and* individual students with strengths or weaknesses in learning language and using language to learn.

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Table 1

Number of Girls and Boys, Mean and Standard Deviation (SD) of Age (months) for Cohorts that Began Longitudinal Study in Grade 1 (Younger) or in Grade 3 (Older), Ethnicity, and Parental Levels of Education

	Younger Cohort					Older Cohort				
				Age					Age	
Grade	N	Girls	Boys	Mean	SD	N	Girls	Boys	Mean	SD
1	128	71	57	82.72	3.80	--	--	--	--	--
2	124	69	55	92.75	3.74	--	--	--	--	--
3	122	68	54	104.24	3.64	113	57	56	106.01	3.70
4	119	67	52	116.51	3.74	110	57	53	116.02	3.67
5	114	62	52	128.36	3.70	106	54	52	127.56	3.75
6	--	--	--	--	--	106	53	53	139.75	3.74
7	--	--	--	--	--	99	50	49	151.29	3.73

Table 2

Means (M) and Standard Deviations (SD) of Standard Scores for Age on WIAT II Standard Scores for Reading Comprehension, Written Expression, Oral Expression, and Listening Comprehension across Longitudinal Study

	Standard Score				
	Younger Cohort			Older Cohort	
	M (SD)			M (SD)	
Listening Comprehension					
Grade 1	109.52	(12.22)	Grade 3	112.58	(10.84)
Grade 3	113.69	(13.90)	Grade 5	116.16	(12.76)
Grade 5	117.50	(12.19)	Grade 7	115.09	(11.00)
Oral Expression					
Grade 1	108.81	(12.01)	Grade 3	113.00	(12.49)
Grade 3	113.56	(13.07)	Grade 5	118.60	(14.48)
Grade 5	119.22	(12.94)	Grade 7	123.62	(14.98)
Reading comprehension					
Grade 1	107.30	(15.74)	Grade 3	115.85	(11.66)
Grade 3	114.38	(14.22)	Grade 5	115.93	(9.45)
Grade 5	115.94	(8.30)	Grade 7	115.52	(7.28)
Written Expression					
Grade 1	98.69	(14.34)	Grade 3	112.09	(13.37)
Grade 3	111.37	(15.20)	Grade 5	112.19	(14.38)
Grade 5	107.78	(12.41)	Grade 7	111.40	(13.84)

Table 3

WIAT 2 Correlations in First and Third Grade Among Measures Used as Indicators of Factors[a, b, c, d] in the CFA Models for Younger Cohort

	1	2	3	4	5	6	7	8	9	Mean	SD
1) Sentence Comp[a]	—	.40	.23	.22	.10	.38	.05	.31	.16	8.53	1.32
2) Rec/Exp Vocab[a]	.35	—	.19	.27	.09	.52	.15	.45	.35	18.40	3.67
3) Visual Pass Retell[b]	.14	.10	—	.15	.40	.34	.25	.33	.30	13.45	4.62
4) Oral Word Fluency[b]	.07	.32	.18	—	.00	.25	.29	.26	.22	22.83	6.13
5) Giving Directions[b]	.34	.28	.24	.22	—	.20	.16	.24	.21	12.22	2.67
6) Read Comp[c]	.40	.34	.29	.26	.37	—	.21	.46	.41	114.21	13.99
7) Writ Word Fluency[d]	.08	.20	.05	.34	.17	.33	—	.17	.30	6.02	2.63
8) Sentence Combine[d]	.31	.33	.09	.14	.30	.53	.27	—	.54	4.66	2.48
9) Paragraph Writing[d]	.07	.17	.08	.12	.14	.42	.27	.36	—	12.22	3.58
Mean	7.24	13.31	8.13	14.73	10.41	106.36	3.71	0.80	8.46		
SD	1.73	3.02	4.07	5.50	2.40	16.19	2.14	1.03	3.91		

Note: Correlations, means and standard deviations (SD) for 1st graders (N=121) are below diagonal (r=.17 or greater, $p < .05$). Correlations, means and standard deviations (SD) for 3rd graders (N=115) are above diagonal (r=.18 or greater, $p < .05$). See Methods for complete names of tasks in each WIAT II subtest. Raw scores for tasks were entered as indicators of latent variables.

[a] Listening Comprehension Factor

[b] Oral Expression Factor

[c] Reading Comprehension Factor

[d] Written Expression Factor

Table 4

WIAT 2 Correlations at Fifth and Seventh Grade Among Measures Used as Indicators of Factors[a, b, c, d] in the CFA for Older Cohort

	1	2	3	4	5	6	7	8	9	Mean	SD
1) Sentence Comp[a]	—	−.01	.07	.05	.08	.14	.16	.06	.06	9.56	0.63
2) Rec/Exp Vocab[a]	.26	—	.13	.29	.19	.48	.01	.26	.28	24.71	3.56
3) Visual Pass Retell[b]	.17	.13	—	.09	.49	.21	.26	.26	.27	19.82	4.88
4) Oral Word Fluency[b]	.00	.43	.13	—	.16	.31	31	.13	.21	31.41	7.40
5) Giving Directions[b]	.09	.15	.29	.11	—	.22	.13	.11	.39	16.91	3.34
6) Reading Comp[c]	.27	.65	.24	.36	.14	—	.19	.37	.35	115.51	7.25
7) Writ Word Fluency[d]	.02	.19	.01	.15	.03	.24	—	.30	.32	12.40	3.95
8) Sentence Combine[d]	.22	.39	.17	.26	.16	.32	.26	—	.45	4.88	2.07
9) Paragraph Writing[d]	.23	.36	.22	.17	.23	.37	.19	.56	—	17.86	4.00
Mean	9.14	22.14	17.86	27.74	14.60	116.27	9.08	6.55	15.54		
SD	0.92	3.85	4.74	5.97	3.44	9.29	3.74	2.38	3.81		

Note: Correlations, means and standard deviations (SD) for 5th graders (N=103) are below diagonal (r=.20 or greater, $p < .05$). Correlations, means and standard deviations (SD) for 7th graders (N=98) are above diagonal (r=.20 or greater, $p < .05$). See Methods for complete names of tasks in each WIAT II subtest. Raw scores for tasks were entered as indicators of latent variables.

[a] Listening Comprehension Factor

[b] Oral Expression Factor

[c] Reading Comprehension Factor

[d] Written Expression Factor

Table 5

WIAT II Confirmatory Factor Analysis (CFAs) for **Younger Cohort** (Four Factor Model)

	Grade 1		Grade 3	
	Loading[a]	**Z**[b]	**Loading**[a]	**Z**[b]
Listening				
Sentence Comprehension	.58	5.20***	.52	5.23***
Receptive/Expressive Vocabulary	.59	4.74***	.77	6.94***
Oral Expression				
Visual Passage Retell	.38	3.52***	.71	5.66***
Word Fluency	.41	3.38***	.27	2.51**
Giving Directions	.60	5.81***	.50	4.06 ***
Reading Comprehension				
Reading Comprehension	1.00	__[c]	1.00	__[c]
Written Expression				
Word Fluency	.43	4.44***	.33	3.91***
Sentences	.69	7.68***	.76	9.19***
Paragraph Writing	.52	6.20***	.69	9.16***
Covariances				
Listening Comp ↔ Oral Expression	.80	4.44***	.43	3.09***
Listening Comp ↔ Reading Comprehension	.63	4.73***	.68	6.05***
Listening Comp ↔ Written Expression	.65	4.45***	.70	6.29***
Oral Expression ↔ Reading Comprehension	.65	4.98***	.48	4.59***
Oral Expression ↔ Written Expression	.62	3.92***	.68	5.67***
Reading Comp ↔ Written Expression	.78	9.56***	.59	5.92***
	$\chi^2(22) = 29.25$[b], p>.05 RMSEA = .06; CFI = .95		$\chi^2(22) = 28.91$[b], p>.05 RMSEA = .05; CFI = .96	

*p<.05

**p<.01

***p<.001

[a] Standardized Value

[b] Based on Robust Standard Errors

[c] Single Indicator of Factor

Table 6

WIAT II Confirmatory Factor Analysis (CFA) for **Older Cohort** (Four Factor Model)

	Grade 5		Grade 7	
	Loading[a]	**Z**[b]	**Loading**[a]	**Z**[b]
Listening				
Sentence Comprehension	.34	3.39***	--	---
Receptive/Expressive Vocabulary	.78	5.53***	1.00	__[c]
Oral Expression				
Visual Passage Retell	.34	2.89***	.65	5.49***
Word Fluency	.52	3.64***	.25	1.89
Giving Directions	.30	2.44***	.72	6.83***
Reading Comprehension				
Reading Comprehension	1.00	__[c]	1.00	__[c]
Written Expression				
Word Fluency	.24	2.36**	.41	4.09***
Sentences	.73	7.25***	.61	5.95***
Paragraph Writing	.76	7.45***	.76	7.11***
Covariances				
Listening Comp ↔ Oral Expression	.84	3.88***	.28	2.62**
Listening Comp ↔ Reading Comprehension	.84	5.72***	.48	3.37***
Listening Comp ↔ Written Expression	.67	4.47***	.34	3.48***
Oral Expression ↔ Reading Comprehension	.66	3.08***	.35	2.31**
Oral Expression ↔ Written Expression	.66	3.30***	.60	5.28***
Reading Comp ↔ Written Expression	.48	3.45***	.48	3.08***
	$\chi^2(22) = 25.46$[b], p>.05 RMSEA = .04; CFI = .97		$\chi^2(15) = 28.37$, p>.05 RMSEA = .09; CFI = .90	

*$p<.05$

**$p<.01$

***$p<.001$

[a] Standardized Value

[b] Based on Robust Standard Errors

[c] Single Indicator of Factor

Table 7

Predicting WIAT II Reading Comprehension from WIAT II Written Expression (WE), Listening Comprehension (LC), and Oral Expression (OE) in Multiple Regression

Cohort and Grade	R^2	F(df)=	p	Standardized beta	t	p
Younger Cohort						
Grade 1	.51	F(3,120)=41.35	,.001			
WE				.42	6.00	<.001
LC				.32	4.66	<.001
OE				.21	2.93	.004
Grade 3	.47	F(3,108)=32.07	<.001			
WE				.30	3.50	.001
LC				.40	5.05	<.001
OE				.16	2.07	.041
Grade 5	.55	F(3,109)=43.75	<.001			
WE				.18	2.58	.011
LC				.59	8.34	<.001
OE				.16	2.30	.024
Older Cohort						
Grade 3	.48	F(3,106)=32.59	<.001			
WE				.40	5.00	<.001
LC				.36	4.50	<.001
OE				.16	2.21	.029
Grade 5	.44	F(3,101)=25.87	<.001			
WE				.13	1.49	.139
LC				.55	6.45	<.001
OE				.10	1.20	.234
Grade 7	.44	F(3,94)=24.27	<.001			
WE				.36	4.17	<.001
LC				.42	5.17	<.001
OE				.08	.95	.343

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Table 8

Predicting WIAT II Written Expression from WIAT II Listening Comprehension (LC), Oral Expression (OE), and Reading Comprehension (RC) in Multiple Regression

Cohort and Grade	R^2	F(df)=	p	Standardized beta	t	p
Younger Cohort						
Grade 1	.35	F(3,120) =21.73	<.001			
LC				−.08	−.89	.375
OE				.14	1.61	.110
RC				.55	6.00	<.001
Grade 3	.40	F(3,108) =24.07	<.001			
LC				.18	1.99	.049
OE				.27	3.29	.001
RC				.34	3.50	.001
Grade 5	.18	F(3,109) =8.05	<.001			
LC				.09	.77	.441
OE				.07	.77	.442
RC				.32	2.58	.011
Older Cohort						
Grade 3	.38	F(3,106) =21.47	<.001			
LC				.19	2.01	.047
OE				.05	.56	.574
RC				.48	5.00	<.001
Grade 5	.25	F(3,101) =11.31	<.001			
LC				.31	2.73	.007
OE				.14	1.57	.12
RC				.17	1.49	.14
Grade 7	.32	F(3,94) =14.43	<.001			
LC				−.03	−.30	.764
OE				.26	2.87	.005
RC				.44	4.17	<.001

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Table 9

Predicting WIAT II Listening Comprehension from WIAT II Oral Expression (OE), Reading Comprehension (RC), and Written Expression (WE) in Multiple Regression

Cohort and Grade	R^2	F(df)=	p	Standardized beta	t	p
Younger Cohort						
Grade 1	.28	F(3,120) =15.23	<.001			
OE				.16	1.79	.076
RC				.48	4.66	<.001
WE				−.09	−.89	.375
Grade 3	.37	F(3,108) =20.99	<.001			
OE				−.00	−.07	.986
RC				.48	5.05	<.001
WE				.19	1.99	.049
Grade 5	.49	F(3,109) =35.47	<.001			
OE				.04	.58	.561
RC				.66	8.34	<.001
WE				.06	.77	.441
Older Cohort						
Grade 3	.34	F(3,106) =17.97	<.001			
OE				−.05	−.54	.59
RC				.45	4.50	<.001
WE				.20	2.01	.047
Grade 5	.46	F(3,101) =28.89	<.001			
OE				.08	.98	0.327
RC				.53	6.45	<.001
WE				.22	2.73	.007
Grade 7	.30	F(3,94) =13.43	<.001			
OE				.10	1.01	.315
RC				.52	5.17	<.001
WE				−.03	−0.30	.764

Table 10

Predicting WIAT II Oral Expression from WIAT II Reading Comprehension (RC), Written Expression (WE), and Listening Comprehension (LC) in Multiple Regression

Cohort and Grade	R^2	F(df)=	p	Standardized beta	t	p
Younger Cohort						
Grade 1	.27	F(3,120) =14.79	<.001			
RC				.32	2.93	.004
WE				.15	1.61	.110
LC				.16	1.79	.076
Grade 3	.25	F(3,108) =12.24	<.001			
RC				.23	2.07	.041
WE				.34	3.29	.001
LC				−.00	−.02	.986
Grade 5	.15	F(3,109) =6.37	.001			
RC				.29	2.30	.024
WE				.08	0.77	.442
LC				.07	0.58	.561
Older Cohort						
Grade 3	.09	F(3,106) =3.27	.024			
RC				.28	2.21	.029
WE				.07	.56	.574
LC				−.06	−.54	.590
Grade 5	.13	F(3,101) =4.89	.003			
RC				.15	1.20	.234
WE				.17	1.57	.121
LC				.12	.98	.327
Grade 7	.19	F(3,94) =7.38	<.001			
RC				.18	.95	.343
WE				.31	2.87	.005
LC				.11	1.01	.315

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Table 11

Means (M) and Standard Deviations (SD) of Ipsatized Individual WIAT II Standard Scores for Reading Comprehension, Written Expression, Oral Expression, and Listening Comprehension Over Time

	Ipsatized Individual Scores				
	Younger			Older	
	M (SD)			M (SD)	
Listening Comprehension					
Grade 1	3.70	(8.69)	Grade 3	−.81	(7.72)
Grade 3	.48	(8.38)	Grade 5	.50	(7.98)
Grade 5	2.51	(7.63)	Grade 7	−1.16	(8.46)
Oral Expression					
Grade 1	2.44	(8.47)	Grade 3	−.38	(9.87)
Grade 3	−.37	(9.10)	Grade 5	2.87	(10.73)
Grade 5	3.99	(9.49)	Grade 7	7.33	(10.28)
Reading Comprehension					
Grade 1	.99	(8.58)	Grade 3	2.42	(6.39)
Grade 3	.89	(7.65)	Grade 5	.30	(6.57)
Grade 5	.73	(5.38)	Grade 7	−.80	(5.97)
Written Expression					
Grade 1	−7.03	(9.61)	Grade 3	−1.44	(8.47)
Grade 3	−1.34	(8.51)	Grade 5	−3.73	(9.76)
Grade 5	−7.23	(9.05)	Grade 7	−5.19	(9.38)

Table 12

Results from Repeated Measures ANOVA on Ipsatized Individual Scores for WIAT II Reading Comprehension, Written Expression, Oral Expression, and Listening Comprehension Over Time (Grades)

	Ipsatized Individual Scores	
	Younger	**Older**
Listening Comprehension		
Time	$F(2,224) = 6.37^{**}$ MSE = 46.94	F (2,194) = 1.74 MSE = 43.23
Oral Expression		
Time	$F(2,212) = 9.26^{***}$ MSE = 56.36	$F(2,192) = 21.41^{***}$ MSE = 67.86
Reading Comprehension		
Time	F (2,222) = .04 MSE = 48.70	$F(2,194) = 8.32^{***}$ MSE = 31.66
Written Expression		
Time	$F(2,216) = 20.10^{***}$ MSE = 60.65	$F(2,192) = 6.05^{**}$ MSE = 57.26

* p<.05

** p<.01

*** p<.001