**SUPPLEMENTARY ONLINE MATERIAL**

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Attainment

**APPENDIX A**

**Testing Measures for Assessment of L1 Achievement and L1 Working Memory**

|  |  |
| --- | --- |
| Test/Subtest | Description |
| **Word Decoding** |  |
| Woodcock Reading Mastery Test-Revised Basic Skills Cluster (WRMT-R)  *Word Identification subtest*  *Word Attack subtest* | Test-retest reliability reported by test’s authors of .96  Ability to read and pronounce increasingly difficult (real) words correctly  Ability to read and pronounce increasingly difficult pseudo (nonsense) words correctly that conform to English spelling rules |
| Test of Word Reading Efficiency (TOWRE) Total Word Efficiency  *Sight Word Efficiency subtest*  *Phonemic Decoding Efficiency subtest* | Test-retest reliability reported by test’s authors of .88-.92  Ability to read and pronounce increasingly difficult (real) words correctly in timed format  Ability to read and pronounce increasingly difficult pseudo (nonsense) words correctly in timed format |
| **Reading Comprehension** |  |
| Stanford Achievement Test 10 | Timed, group-administered standardized measures of reading comprehension skills and/or language ability. The student reads passages/items silently and answers multiple choice questions. Test-retest reliability reported by test’s authors of .87 |

|  |  |
| --- | --- |
| **Vocabulary** |  |
| Woodcock-Johnson-III Picture Vocabulary subtest | Test measures expressive vocabulary for standard American English. Student shown a series of pictures and identifies aloud name of the picture. Student is not penalized for mispronunciations from articulation errors, dialect variations, or regional speech patterns. Words increase in difficulty as test progresses. Test-retest reliability reported by test’s authors of .81. |
| **Language Analysis** |  |
| Test of Language Competence-Expanded (TLC-E) Figurative Language subtest | Test measures ability to interpret figurative expressions (idioms, metaphors, e.g., *It’s all behind us now*.) Examiner reads expression aloud and student interprets meaning of expression. Then, examiner reads aloud four metaphoric expressions (printed on page) to student, who chooses expression closest in meaning to a metaphoric expression, e.g., *It’s water under the bridge.* |
| **Writing** |  |
| On-Demand Writing Assessment | Test measures ability to write response to two types of prompt stimuli: short prompt outlining a situation and extended prompt with a reading passage. Score is determined by performance in three writing domains of: content, structure, writing conventions. |
| **Memory** |  |
| Comprehensive Test of Phonological Processing, Phonological Memory Composite (CTOPP)      *Nonword Repetition subtest*  *Memory for Digits subtest* | Ability to code information phonologically for temporary storage in working or short-term memory. Test-retest reliability reported by test’s authors of .83-.86  Measures ability to listen to recorded pseudowords of 3-15 sounds and repeat words.  Measures ability to repeat series of 2-8 digits in order. |
| Woodcock-Johnson-III/NU Working Memory Cluster  *Auditory Working Memory* subtest  *Numbers Reversed* subtest | Ability to hold information in immediate awareness while performing mental operation on information.  Measures ability to listen to series of numbers and words and reorder information into two discrete categories in particular order, i.e., say the words first, then say the numbers in the same order presented, e.g., *3-word-8-table* would be repeated as *word-table-3-8*. Test-retest reliability reported by test’s authors of .90.  *Numbers Reversed* subtest measures ability to hold series of digits in memory and repeat digits backwards. Items became increasingly difficult on both subtests. Test-retest reliability reported by test’s authors of .87. |
| **Metacognitive Knowledge** |  |
| Metalinguistic Knowledge Questionnaire | Questionnaire includes 64 items assessing knowledge about texts, reading, and writing. Original questionnaire was about Dutch texts, wording of some items changed to reflect English conventions. Student reads each item, decides whether s/he agrees or disagrees (*yes*/*no*). Examples of correct/ incorrect statements: *To be able to understand a text properly, you sometimes need to know things that are not said in the text* (yes); *If you read a text to find a specific piece of information quickly* (e.g., a date), *It is sensible to read the text thoroughly* (no). Cronbach’s alpha of .90. |

**APPENDIX B**

**Testing Measures for Assessment of L2 Aptitude, L2 (Spanish) Achievement**

|  |  |
| --- | --- |
| Test/Subtest | Description |
| **L2 Aptitude** |  |
| Modern Language Aptitude Test (MLAT) | Test designed to provide indication of student’s probable degree of success in learning L2, includes 5 subtests: *Number Learning, Phonetic Script, Spelling Clues, Words in Sentences*, and *Paired Associates.* Test-retest reliability reported by test’s authors of .90 for males and .91 for females. |
| **L2 Word Decoding** |  |
| Woodcock Muñoz Identificación de letras y palabras subtest | Ability to read and pronounce correctly increasingly difficult (real) Spanish words, one syllable to multisyllabic words. The difficulty level of the words ranged from one-syllable (*vez*, *pan*) to two- and three-syllable (*joven*, *ciuidado*) and multisyllabic (*desalmado*, *municipalidad*) words. Test-retest reliability reported by test’s authors of .91. |
| **L2 Reading Comprehension** |  |
| Woodcock Muñoz Comprensión de textos subtest | Ability to read increasingly difficult short passages with modified cloze procedure and identify missing key Spanish word that makes sense within context, e.g., *Luis y Rosa \_\_\_\_ amigos.* Test-retest reliability reported by test’s authors of .90. |
| **L2 Listening Comprehension** |  |
| Woodcock Muñoz Comprensión oral subtest | Ability to listen to short passage from recording using modified cloze procedure and supply missing Spanish word using syntactic and semantic cues located at end of each item. Test begins with simple sentences, e.g. *Los niños estudian en la* \_\_\_\_\_\_ , and progresses to more complex passages, e.g., *Los vientos traen aire, los ríos traen* \_\_\_\_\_. Test-retest reliability reported by test’s authors of .80. |
| **L2 Vocabulary** |  |
| Woodcock Muñoz Vocabulario sobre dibujos subtest | Ability to name orally from memory common to less frequent objects in environment shown in picture with the correct Spanish word. Test-retest reliability reported by test’s authors of .89. |
| **L2 Spelling** |  |
| Woodcock Muñoz Ortografia subtest | Ability to spell (write) increasingly difficult Spanish words presented orally, e.g., *tres, por, abuelo, lección, gimnasio*.  Items recorded and presented to participants who wear headphones. Test-retest reliability reported by test’s authors of .86. |
| **L2 Writing** |  |
| Woodcock Muñoz Muestras de redacción subtest | Ability to write sentences in Spanish when given verbal direction, sometimes accompanied by picture. Difficulty of items is enhanced by increasing length, level of vocabulary, grammatical complexities, and level of concept abstraction. Student is not penalized for spelling/punctuation errors, sentences evaluated with respect to criteria in test manual. Test-retest reliability reported by test’s authors of .89. |
| **L2 Oral Proficiency** |  |
| Oral Proficiency Interview | Interviewers used randomly selected topics for the interviews (e.g., family, food, school, friends, daily activities). Each interview was recorded to be scored by the two L2 educators at a later date. The interview was scored for five criteria according to a rubric developed by the L2 educators adapted from the ACTFL Speaking Guidelines (1999) and the AAPPL Rating Criteria (2017): vocabulary and discourse range, comprehensibility (accent and pronunciation), language comprehension, language control (grammar, word choice, word order), and task completion (score of 0-4 for each part, maximum score = 20). Inter-rater reliability for the L2 oral interviews was .89. |

**Table S1**

*Correlations Among L1, L2, and MLAT Measures*

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | L1 Word  decode | L1 Vocab | L1 Memory | L1 Lang  Analysis | L1 Read Comp | L1 Writing | MLAT Long  Form SS |
| L1 Vocab |  | .338 |  |  |  |  |  |  |
|  | <.001 |  |  |  |  |  |  |
| L1 Memory |  | .486 | .245 |  |  |  |  |  |
|  | <.001 | <.001 |  |  |  |  |  |
| L1 Lang Analysis |  | .292 | .353 | .284 |  |  |  |  |
|  | <.001 | <.001 | <.001 |  |  |  |  |
| L1 Read Comp |  | .356 | .217 | .207 | .332 |  |  |  |
|  | <.001 | <.001 | <.001 | <.001 |  |  |  |
| L1 Writing |  | .332 | .149 | .227 | .248 | .333 |  |  |
|  | <.001 | .009 | <.001 | <.001 | <.001 |  |  |
| MLAT Long Form |  | .443 | .302 | .365 | .325 | .280 | .233 |  |
|  | <.001 | <.001 | <.001 | <.001 | <.001 | <.001 |  |
| L2 Reading Yr 1 |  | .545 | .277 | .291 | .235 | .245 | .200 | .389 |
|  | <.001 | <.001 | <.001 | <.001 | <.001 | <.001 | <.001 |
| L2 Writing Yr 1 |  | .414 | .338 | .261 | .226 | .197 | .260 | .425 |
|  | <.001 | <.001 | <.001 | <.001 | <.001 | <.001 | <.001 |
| L2 Listen Comp Yr 1 |  | .310 | .364 | .174 | .201 | .185 | .210 | .422 |
|  | <.001 | <.001 | .002 | <.001 | .001 | <.001 | <.001 |
| L2 Reading Yr 2 |  | .632 | .303 | .324 | .248 | .326 | .367 | .457 |
|  | <.001 | <.001 | <.001 | <.001 | <.001 | <.001 | <.001 |
| L2 Writing Yr 2 |  | .521 | .392 | .322 | .270 | .282 | .285 | .479 |
|  | <.001 | <.001 | <.001 | <.001 | <.001 | <.001 | <.001 |
| L2 Listen Comp Yr 2 |  | .441 | .402 | .223 | .278 | .348 | .351 | .452 |
|  | <.001 | <.001 | <.001 | <.001 | <.001 | <.001 | <.001 |
| Span 2 OPI |  | .343 | .178 | .151 | .172 | .325 | .324 | .326 |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | | L2 Reading  Yr 1 | L2 Writing  Yr 1 | L2 Listen Comp  Yr 1 | L2 Reading  Yr 2 | L2 Writing  Yr 2 | L2 Listen Comp  Yr 2 |
| L1 Vocab |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
| L1 Memory |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
| L1 Lang Analysis |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
| L1 Read Comp |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
| L1 Writing |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
| MLAT Long Form |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
| L2 Reading Yr 1 |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
| L2 Writing Yr 1 |  | .488 |  |  |  |  |  |
|  | <.001 |  |  |  |  |  |
| L2 Listen Comp Yr 1 |  | .470 | .618 |  |  |  |  |
|  | <.001 | <.001 |  |  |  |  |
| L2 Reading Yr 2 |  | .623 | .533 | .411 |  |  |  |
|  | <.001 | <.001 | <.001 |  |  |  |
| L2 Writing Yr 2 |  | .569 | .838 | .614 | .645 |  |  |
|  | <.001 | <.001 | <.001 | <.001 |  |  |
| L2 Listen Comp Yr 2 |  | .489 | .585 | .678 | .590 | .714 |  |
|  | <.001 | <.001 | <.001 | <.001 | <.001 |  |
| Span 2 OPI |  | .383 | .432 | .422 | .508 | .502 | .566 |
|  | <.001 | <.001 | <.001 | <.001 | <.001 | <.001 |

*Note*. All *n* = 307, following imputation.

**Table S2**

*Effect of Adding a Word Decoding Measure to MLAT in predicting L2 Attainment*

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Predictor | Reading  Yr1 | Reading  Yr2 | ListenComp  Yr1 | ListenComp  Yr2 | Writing  Yr1 | Writing  Yr2 |
| MLAT  alone | 15.1 | 20.9 | 17.8 | 20.4 | 18.1 | 22.9 |
| MLAT  +WRMT | 30.4 | 39.5 | 19.5 | 26.5 | 24.4 | 35.0 |
| MLAT  +TOWRE | 26.2 | 36.8 | 19.0 | 25.2 | 21.6 | 29.3 |

*Note.* All results are proportions (%) of variance.