SPSS Model 4a: Hybrid with Fixed Main Effects Only

**Mixed Model Analysis**

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| **Notes** |  |  |
| Output Created |  | 23-SEP-2023 15:54:02 |
| Comments |  |  |
| Input | Active Dataset | Example |
| Filter | <none> |
| Weight | <none> |
| Split File | <none> |
| N of Rows in Working Data File | 3566 |
| Missing Value Handling | Definition of Missing | User-defined missing values are treated as valid data. |
| Cases Used | Statistics are based on all cases with valid data for all variables in the model. |
| Weight Handling |  | not applicable |
| Syntax |  | MIXED langpost BY schoolID WITH hw2 mixgrd CMverb10 verb10 WCverb /METHOD = REML /CRITERIA = DFMETHOD(SATTERTHWAITE) /PRINT = SOLUTION TESTCOV /FIXED = hw2 mixgrd CMverb10 verb10 /RANDOM = INTERCEPT WCverb | COVTYPE(UN) SUBJECT(schoolID). |
| Resources | Processor Time | 00:00:00.22 |
| Elapsed Time | 00:00:00.20 |

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| **Model Dimension**a |  |  |  |  |  |
|  |  | Number of Levels | Covariance Structure | Number of Parameters | Subject Variables |
| Fixed Effects | Intercept | 1 |  | 1 |  |
| hw2 | 1 |  | 1 |  |
| mixgrd | 1 |  | 1 |  |
| CMverb10 | 1 |  | 1 |  |
| verb10 | 1 |  | 1 |  |
| Random Effects | Intercept + WCverb | 2 | Unstructured | 3 | schoolID |
| Residual |  |  |  | 1 |  |
| Total |  | 7 |  | 9 |  |

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| a. Dependent Variable: langpost. |  |  |  |  |  |

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| **Information Criteria**a |  |
| -2 Restricted Log Likelihood | 23595.78283814 |
| Akaike's Information Criterion (AIC) | 23603.78283814 |
| Hurvich and Tsai's Criterion (AICC) | 23603.79408673 |
| Bozdogan's Criterion (CAIC) | 23632.49402487 |
| Schwarz's Bayesian Criterion (BIC) | 23628.49402487 |

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| The information criteria are displayed in smaller-is-better form.a |  |
| a. Dependent Variable: langpost. |  |

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| **Coefficients of Determination** |  |  |
| Pseudo-R Square Measures | Marginal | .378 |
| Conditional | .495 |

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| **Intraclass Correlation Coefficients** |  |  |
| Overall ICCs | Adjusted | .189 |
| Conditional | .117 |

**Fixed Effects**

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| **Type III Tests of Fixed Effects**a |  |  |  |  |
| Source | Numerator df | Denominator df | F | Sig. |
| Intercept | 1 | 176.881 | 13486.392 | <.001 |
| hw2 | 1 | 177.677 | .045 | .832 |
| mixgrd | 1 | 200.922 | 3.416 | .066 |
| CMverb10 | 1 | 235.104 | 18.447 | <.001 |
| verb10 | 1 | 151.568 | 1285.811 | <.001 |

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| a. Dependent Variable: langpost. |  |  |  |  |

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| **Estimates of Fixed Effects**a |  |  |  |  |  |  |  |
| Parameter | Estimate | Std. Error | df | t | Sig. | 95% Confidence Interval |  |
| Lower Bound | Upper Bound |
| Intercept | 41.528 | .358 | 176.881 | 116.131 | <.001 | 40.822 | 42.234 |
| hw2 | -.095 | .446 | 177.677 | -.213 | .832 | -.976 | .786 |
| mixgrd | -.934 | .505 | 200.922 | -1.848 | .066 | -1.930 | .063 |
| CMverb10 | 1.173 | .273 | 235.104 | 4.295 | <.001 | .635 | 1.710 |
| verb10 | 2.449 | .068 | 151.568 | 35.858 | <.001 | 2.314 | 2.583 |

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| a. Dependent Variable: langpost. |  |  |  |  |  |  |  |

**Covariance Parameters**

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| **Estimates of Covariance Parameters**a |  |  |  |  |  |  |
| Parameter |  | Estimate | Std. Error | Wald Z | Sig. | 95% Confidence Interval |
|  | Lower Bound |
| Residual |  | 39.758 | .991 | 40.119 | <.001 | 37.862 |
| Intercept + WCverb [subject = schoolID] | UN (1,1) | 8.467 | 1.135 | 7.456 | <.001 | 6.510 |
| UN (2,1) | -.694 | .238 | -2.910 | .004 | -1.161 |
| UN (2,2) | .223 | .086 | 2.593 | .010 | .105 |

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| **Estimates of Covariance Parameters**a |  |  |
| Parameter |  | 95% Confidence Interval |
|  | Upper Bound |
| Residual |  | 41.748 |
| Intercept + WCverb [subject = schoolID] | UN (1,1) | 11.012 |
| UN (2,1) | -.227 |
| UN (2,2) | .476 |

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| a. Dependent Variable: langpost. |  |  |

SPSS Model 4b: Smushed Random Slope with Fixed Main Effects Only

**Mixed Model Analysis**

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| **Notes** |  |  |
| Output Created |  | 23-SEP-2023 15:54:02 |
| Comments |  |  |
| Input | Active Dataset | Example |
| Filter | <none> |
| Weight | <none> |
| Split File | <none> |
| N of Rows in Working Data File | 3566 |
| Missing Value Handling | Definition of Missing | User-defined missing values are treated as valid data. |
| Cases Used | Statistics are based on all cases with valid data for all variables in the model. |
| Weight Handling |  | not applicable |
| Syntax |  | MIXED langpost BY schoolID WITH hw2 mixgrd CMverb10 verb10 /METHOD = REML /CRITERIA = DFMETHOD(SATTERTHWAITE) /PRINT = SOLUTION TESTCOV /FIXED = hw2 mixgrd CMverb10 verb10 /RANDOM = INTERCEPT verb10 | COVTYPE(UN) SUBJECT(schoolID). |
| Resources | Processor Time | 00:00:00.16 |
| Elapsed Time | 00:00:00.19 |

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| **Model Dimension**a |  |  |  |  |  |
|  |  | Number of Levels | Covariance Structure | Number of Parameters | Subject Variables |
| Fixed Effects | Intercept | 1 |  | 1 |  |
| hw2 | 1 |  | 1 |  |
| mixgrd | 1 |  | 1 |  |
| CMverb10 | 1 |  | 1 |  |
| verb10 | 1 |  | 1 |  |
| Random Effects | Intercept + verb10 | 2 | Unstructured | 3 | schoolID |
| Residual |  |  |  | 1 |  |
| Total |  | 7 |  | 9 |  |

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| a. Dependent Variable: langpost. |  |  |  |  |  |

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| **Information Criteria**a |  |
| -2 Restricted Log Likelihood | 23597.09922357 |
| Akaike's Information Criterion (AIC) | 23605.09922357 |
| Hurvich and Tsai's Criterion (AICC) | 23605.11047216 |
| Bozdogan's Criterion (CAIC) | 23633.81041030 |
| Schwarz's Bayesian Criterion (BIC) | 23629.81041030 |

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| The information criteria are displayed in smaller-is-better form.a |  |
| a. Dependent Variable: langpost. |  |

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| **Coefficients of Determination** |  |  |
| Pseudo-R Square Measures | Marginal | .374 |
| Conditional | .493 |

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| **Intraclass Correlation Coefficients** |  |  |
| Overall ICCs | Adjusted | .189 |
| Conditional | .118 |

**Fixed Effects**

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| --- | --- | --- | --- | --- |
| **Type III Tests of Fixed Effects**a |  |  |  |  |
| Source | Numerator df | Denominator df | F | Sig. |
| Intercept | 1 | 179.388 | 13399.705 | <.001 |
| hw2 | 1 | 178.957 | .169 | .682 |
| mixgrd | 1 | 202.082 | 3.181 | .076 |
| CMverb10 | 1 | 232.374 | 15.916 | <.001 |
| verb10 | 1 | 159.821 | 1328.251 | <.001 |

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| a. Dependent Variable: langpost. |  |  |  |  |

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| **Estimates of Fixed Effects**a |  |  |  |  |  |  |  |
| Parameter | Estimate | Std. Error | df | t | Sig. | 95% Confidence Interval |  |
| Lower Bound | Upper Bound |
| Intercept | 41.579 | .359 | 179.388 | 115.757 | <.001 | 40.870 | 42.288 |
| hw2 | -.184 | .448 | 178.957 | -.411 | .682 | -1.069 | .700 |
| mixgrd | -.904 | .507 | 202.082 | -1.784 | .076 | -1.904 | .095 |
| CMverb10 | 1.114 | .279 | 232.374 | 3.989 | <.001 | .564 | 1.664 |
| verb10 | 2.446 | .067 | 159.821 | 36.445 | <.001 | 2.314 | 2.579 |

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| a. Dependent Variable: langpost. |  |  |  |  |  |  |  |

**Covariance Parameters**

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| **Estimates of Covariance Parameters**a |  |  |  |  |  |  |
| Parameter |  | Estimate | Std. Error | Wald Z | Sig. | 95% Confidence Interval |
|  | Lower Bound |
| Residual |  | 39.810 | .992 | 40.145 | <.001 | 37.913 |
| Intercept + verb10 [subject = schoolID] | UN (1,1) | 8.512 | 1.144 | 7.440 | <.001 | 6.541 |
| UN (2,1) | -.695 | .237 | -2.937 | .003 | -1.159 |
| UN (2,2) | .199 | .081 | 2.464 | .014 | .090 |

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| **Estimates of Covariance Parameters**a |  |  |
| Parameter |  | 95% Confidence Interval |
|  | Upper Bound |
| Residual |  | 41.802 |
| Intercept + verb10 [subject = schoolID] | UN (1,1) | 11.077 |
| UN (2,1) | -.231 |
| UN (2,2) | .441 |

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| a. Dependent Variable: langpost. |  |  |

SPSS Model 4c: Hybrid with Smushed Cross-Level Interaction

**Mixed Model Analysis**

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| **Notes** |  |  |
| Output Created |  | 23-SEP-2023 15:54:02 |
| Comments |  |  |
| Input | Active Dataset | Example |
| Filter | <none> |
| Weight | <none> |
| Split File | <none> |
| N of Rows in Working Data File | 3566 |
| Missing Value Handling | Definition of Missing | User-defined missing values are treated as valid data. |
| Cases Used | Statistics are based on all cases with valid data for all variables in the model. |
| Weight Handling |  | not applicable |
| Syntax |  | MIXED langpost BY schoolID WITH hw2 mixgrd CMverb10 verb10 WCverb /METHOD = REML /CRITERIA = DFMETHOD(SATTERTHWAITE) /PRINT = SOLUTION TESTCOV /FIXED = hw2 mixgrd CMverb10 verb10 mixgrd\*verb10 /RANDOM = INTERCEPT WCverb | COVTYPE(UN) SUBJECT(schoolID). |
| Resources | Processor Time | 00:00:00.22 |
| Elapsed Time | 00:00:00.28 |

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| **Model Dimension**a |  |  |  |  |  |
|  |  | Number of Levels | Covariance Structure | Number of Parameters | Subject Variables |
| Fixed Effects | Intercept | 1 |  | 1 |  |
| hw2 | 1 |  | 1 |  |
| mixgrd | 1 |  | 1 |  |
| CMverb10 | 1 |  | 1 |  |
| verb10 | 1 |  | 1 |  |
| mixgrd \* verb10 | 1 |  | 1 |  |
| Random Effects | Intercept + WCverb | 2 | Unstructured | 3 | schoolID |
| Residual |  |  |  | 1 |  |
| Total |  | 8 |  | 10 |  |

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| a. Dependent Variable: langpost. |  |  |  |  |  |

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| **Information Criteria**a |  |
| -2 Restricted Log Likelihood | 23591.72011025 |
| Akaike's Information Criterion (AIC) | 23599.72011025 |
| Hurvich and Tsai's Criterion (AICC) | 23599.73136200 |
| Bozdogan's Criterion (CAIC) | 23628.43017354 |
| Schwarz's Bayesian Criterion (BIC) | 23624.43017354 |

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| The information criteria are displayed in smaller-is-better form.a |  |
| a. Dependent Variable: langpost. |  |

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| **Coefficients of Determination** |  |  |
| Pseudo-R Square Measures | Marginal | .376 |
| Conditional | .493 |

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| **Intraclass Correlation Coefficients** |  |  |
| Overall ICCs | Adjusted | .188 |
| Conditional | .117 |

**Fixed Effects**

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| --- | --- | --- | --- | --- |
| **Type III Tests of Fixed Effects**a |  |  |  |  |
| Source | Numerator df | Denominator df | F | Sig. |
| Intercept | 1 | 176.896 | 13476.533 | <.001 |
| hw2 | 1 | 177.973 | .033 | .856 |
| mixgrd | 1 | 198.931 | 5.110 | .025 |
| CMverb10 | 1 | 245.362 | 14.323 | <.001 |
| verb10 | 1 | 128.192 | 912.737 | <.001 |
| mixgrd \* verb10 | 1 | 280.993 | 6.044 | .015 |

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| a. Dependent Variable: langpost. |  |  |  |  |

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| **Estimates of Fixed Effects**a |  |  |  |  |  |  |  |
| Parameter | Estimate | Std. Error | df | t | Sig. | 95% Confidence Interval |  |
| Lower Bound | Upper Bound |
| Intercept | 41.623 | .359 | 176.896 | 116.088 | <.001 | 40.915 | 42.330 |
| hw2 | -.081 | .445 | 177.973 | -.182 | .856 | -.958 | .797 |
| mixgrd | -1.158 | .512 | 198.931 | -2.261 | .025 | -2.167 | -.148 |
| CMverb10 | 1.047 | .277 | 245.362 | 3.785 | <.001 | .502 | 1.592 |
| verb10 | 2.354 | .078 | 128.192 | 30.212 | <.001 | 2.200 | 2.508 |
| mixgrd \* verb10 | .369 | .150 | 280.993 | 2.458 | .015 | .074 | .665 |

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| a. Dependent Variable: langpost. |  |  |  |  |  |  |  |

**Covariance Parameters**

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| **Estimates of Covariance Parameters**a |  |  |  |  |  |  |
| Parameter |  | Estimate | Std. Error | Wald Z | Sig. | 95% Confidence Interval |
|  | Lower Bound |
| Residual |  | 39.734 | .990 | 40.128 | <.001 | 37.840 |
| Intercept + WCverb [subject = schoolID] | UN (1,1) | 8.419 | 1.129 | 7.456 | <.001 | 6.473 |
| UN (2,1) | -.711 | .235 | -3.021 | .003 | -1.172 |
| UN (2,2) | .217 | .085 | 2.539 | .011 | .100 |

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| **Estimates of Covariance Parameters**a |  |  |
| Parameter |  | 95% Confidence Interval |
|  | Upper Bound |
| Residual |  | 41.723 |
| Intercept + WCverb [subject = schoolID] | UN (1,1) | 10.950 |
| UN (2,1) | -.250 |
| UN (2,2) | .470 |

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| a. Dependent Variable: langpost. |  |  |

SPSS Model 4d: Hybrid with Unsmushed Cross-Level Interaction

**Mixed Model Analysis**

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| **Notes** |  |  |
| Output Created |  | 23-SEP-2023 15:54:02 |
| Comments |  |  |
| Input | Active Dataset | Example |
| Filter | <none> |
| Weight | <none> |
| Split File | <none> |
| N of Rows in Working Data File | 3566 |
| Missing Value Handling | Definition of Missing | User-defined missing values are treated as valid data. |
| Cases Used | Statistics are based on all cases with valid data for all variables in the model. |
| Weight Handling |  | not applicable |
| Syntax |  | MIXED langpost BY schoolID WITH hw2 mixgrd CMverb10 verb10 WCverb /METHOD = REML /CRITERIA = DFMETHOD(SATTERTHWAITE) /PRINT = SOLUTION TESTCOV /FIXED = hw2 mixgrd CMverb10 verb10 mixgrd\*verb10 mixgrd\*CMverb10 /RANDOM = INTERCEPT WCverb | COVTYPE(UN) SUBJECT(schoolID) /TEST = "Simple L2 between" verb10 1 CMverb10 1 /TEST = "L2 between\*mixgrd" mixgrd\*verb10 1 mixgrd\*CMverb10 1. |
| Resources | Processor Time | 00:00:00.23 |
| Elapsed Time | 00:00:00.23 |

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| **Model Dimension**a |  |  |  |  |  |
|  |  | Number of Levels | Covariance Structure | Number of Parameters | Subject Variables |
| Fixed Effects | Intercept | 1 |  | 1 |  |
| hw2 | 1 |  | 1 |  |
| mixgrd | 1 |  | 1 |  |
| CMverb10 | 1 |  | 1 |  |
| verb10 | 1 |  | 1 |  |
| mixgrd \* verb10 | 1 |  | 1 |  |
| mixgrd \* CMverb10 | 1 |  | 1 |  |
| Random Effects | Intercept + WCverb | 2 | Unstructured | 3 | schoolID |
| Residual |  |  |  | 1 |  |
| Total |  | 9 |  | 11 |  |

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| a. Dependent Variable: langpost. |  |  |  |  |  |

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| **Information Criteria**a |  |
| -2 Restricted Log Likelihood | 23590.50901138 |
| Akaike's Information Criterion (AIC) | 23598.50901138 |
| Hurvich and Tsai's Criterion (AICC) | 23598.52026630 |
| Bozdogan's Criterion (CAIC) | 23627.21795092 |
| Schwarz's Bayesian Criterion (BIC) | 23623.21795092 |

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| The information criteria are displayed in smaller-is-better form.a |  |
| a. Dependent Variable: langpost. |  |

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| **Coefficients of Determination** |  |  |
| Pseudo-R Square Measures | Marginal | .375 |
| Conditional | .493 |

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| **Intraclass Correlation Coefficients** |  |  |
| Overall ICCs | Adjusted | .188 |
| Conditional | .118 |

**Fixed Effects**

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| --- | --- | --- | --- | --- |
| **Type III Tests of Fixed Effects**a |  |  |  |  |
| Source | Numerator df | Denominator df | F | Sig. |
| Intercept | 1 | 176.258 | 13420.217 | <.001 |
| hw2 | 1 | 177.413 | .022 | .882 |
| mixgrd | 1 | 196.434 | 4.679 | .032 |
| CMverb10 | 1 | 181.620 | 4.147 | .043 |
| verb10 | 1 | 123.603 | 903.310 | <.001 |
| mixgrd \* verb10 | 1 | 238.599 | 4.604 | .033 |
| mixgrd \* CMverb10 | 1 | 234.874 | .558 | .456 |

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| a. Dependent Variable: langpost. |  |  |  |  |

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| **Estimates of Fixed Effects**a |  |  |  |  |  |  |
| Parameter | Estimate | Std. Error | df | t | Sig. | 95% Confidence Interval |
| Lower Bound |
| Intercept | 41.622 | .359 | 176.258 | 115.846 | <.001 | 40.913 |
| hw2 | -.066 | .446 | 177.413 | -.149 | .882 | -.946 |
| mixgrd | -1.117 | .516 | 196.434 | -2.163 | .032 | -2.134 |
| CMverb10 | .825 | .405 | 181.620 | 2.036 | .043 | .026 |
| verb10 | 2.361 | .079 | 123.603 | 30.055 | <.001 | 2.206 |
| mixgrd \* verb10 | .336 | .157 | 238.599 | 2.146 | .033 | .028 |
| mixgrd \* CMverb10 | .414 | .554 | 234.874 | .747 | .456 | -.677 |

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| **Estimates of Fixed Effects**a |  |
| Parameter | 95% Confidence Interval |
| Upper Bound |
| Intercept | 42.331 |
| hw2 | .813 |
| mixgrd | -.099 |
| CMverb10 | 1.625 |
| verb10 | 2.517 |
| mixgrd \* verb10 | .645 |
| mixgrd \* CMverb10 | 1.504 |

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| a. Dependent Variable: langpost. |  |

**Covariance Parameters**

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| **Estimates of Covariance Parameters**a |  |  |  |  |  |  |
| Parameter |  | Estimate | Std. Error | Wald Z | Sig. | 95% Confidence Interval |
|  | Lower Bound |
| Residual |  | 39.731 | .990 | 40.132 | <.001 | 37.838 |
| Intercept + WCverb [subject = schoolID] | UN (1,1) | 8.467 | 1.137 | 7.447 | <.001 | 6.508 |
| UN (2,1) | -.720 | .236 | -3.056 | .002 | -1.182 |
| UN (2,2) | .217 | .085 | 2.544 | .011 | .101 |

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| --- | --- | --- |
| **Estimates of Covariance Parameters**a |  |  |
| Parameter |  | 95% Confidence Interval |
|  | Upper Bound |
| Residual |  | 41.720 |
| Intercept + WCverb [subject = schoolID] | UN (1,1) | 11.016 |
| UN (2,1) | -.258 |
| UN (2,2) | .470 |

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| a. Dependent Variable: langpost. |  |  |

**Custom Hypothesis Test 1 (Simple L2 between)**

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| **Contrast Estimates**a,b |  |  |  |  |  |  |  |
| Contrast | Estimate | Std. Error | df | Test Value | t | Sig. | 95% Confidence Interval |
| Lower Bound |
| L1 | 3.187 | .399 | 171.550 | 0 | 7.981 | <.001 | 2.399 |

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| **Contrast Estimates**a,b |  |
| Contrast | 95% Confidence Interval |
| Upper Bound |
| L1 | 3.975 |

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| a. Simple L2 between |  |
| b. Dependent Variable: langpost. |  |

**Custom Hypothesis Test 2 (L2 between\*mixgrd)**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Contrast Estimates**a,b |  |  |  |  |  |  |  |
| Contrast | Estimate | Std. Error | df | Test Value | t | Sig. | 95% Confidence Interval |
| Lower Bound |
| L1 | .750 | .531 | 199.363 | 0 | 1.413 | .159 | -.297 |

|  |  |
| --- | --- |
| **Contrast Estimates**a,b |  |
| Contrast | 95% Confidence Interval |
| Upper Bound |
| L1 | 1.797 |

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| --- | --- |
| a. L2 between\*mixgrd |  |
| b. Dependent Variable: langpost. |  |

SPSS Model 4e: Cluster-MC with Unsmushed Cross-Level Interaction

**Mixed Model Analysis**

|  |  |  |
| --- | --- | --- |
| **Notes** |  |  |
| Output Created |  | 23-SEP-2023 15:54:03 |
| Comments |  |  |
| Input | Active Dataset | Example |
| Filter | <none> |
| Weight | <none> |
| Split File | <none> |
| N of Rows in Working Data File | 3566 |
| Missing Value Handling | Definition of Missing | User-defined missing values are treated as valid data. |
| Cases Used | Statistics are based on all cases with valid data for all variables in the model. |
| Weight Handling |  | not applicable |
| Syntax |  | MIXED langpost BY schoolID WITH hw2 mixgrd CMverb10 WCverb /METHOD = REML /CRITERIA = DFMETHOD(SATTERTHWAITE) /PRINT = SOLUTION TESTCOV /FIXED = hw2 mixgrd CMverb10 WCverb mixgrd\*WCverb mixgrd\*CMverb10 /RANDOM = INTERCEPT WCverb | COVTYPE(UN) SUBJECT(schoolID) /TEST = "Simple L2 context" WCverb -1 CMverb10 1 /TEST = "L2 context\*mixgrd" mixgrd\*WCverb -1 mixgrd\*CMverb10 1. |
| Resources | Processor Time | 00:00:00.20 |
| Elapsed Time | 00:00:00.24 |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Model Dimension**a |  |  |  |  |  |
|  |  | Number of Levels | Covariance Structure | Number of Parameters | Subject Variables |
| Fixed Effects | Intercept | 1 |  | 1 |  |
| hw2 | 1 |  | 1 |  |
| mixgrd | 1 |  | 1 |  |
| CMverb10 | 1 |  | 1 |  |
| WCverb | 1 |  | 1 |  |
| mixgrd \* WCverb | 1 |  | 1 |  |
| mixgrd \* CMverb10 | 1 |  | 1 |  |
| Random Effects | Intercept + WCverb | 2 | Unstructured | 3 | schoolID |
| Residual |  |  |  | 1 |  |
| Total |  | 9 |  | 11 |  |

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| --- | --- | --- | --- | --- | --- |
| a. Dependent Variable: langpost. |  |  |  |  |  |

|  |  |
| --- | --- |
| **Information Criteria**a |  |
| -2 Restricted Log Likelihood | 23590.50901138 |
| Akaike's Information Criterion (AIC) | 23598.50901138 |
| Hurvich and Tsai's Criterion (AICC) | 23598.52026630 |
| Bozdogan's Criterion (CAIC) | 23627.21795092 |
| Schwarz's Bayesian Criterion (BIC) | 23623.21795092 |

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| --- | --- |
| The information criteria are displayed in smaller-is-better form.a |  |
| a. Dependent Variable: langpost. |  |

|  |  |  |
| --- | --- | --- |
| **Coefficients of Determination** |  |  |
| Pseudo-R Square Measures | Marginal | .375 |
| Conditional | .493 |

|  |  |  |
| --- | --- | --- |
| **Intraclass Correlation Coefficients** |  |  |
| Overall ICCs | Adjusted | .188 |
| Conditional | .118 |

**Fixed Effects**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Type III Tests of Fixed Effects**a |  |  |  |  |
| Source | Numerator df | Denominator df | F | Sig. |
| Intercept | 1 | 176.258 | 13420.217 | <.001 |
| hw2 | 1 | 177.413 | .022 | .882 |
| mixgrd | 1 | 196.434 | 4.679 | .032 |
| CMverb10 | 1 | 171.550 | 63.695 | <.001 |
| WCverb | 1 | 123.603 | 903.310 | <.001 |
| mixgrd \* WCverb | 1 | 238.599 | 4.604 | .033 |
| mixgrd \* CMverb10 | 1 | 199.363 | 1.996 | .159 |

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| a. Dependent Variable: langpost. |  |  |  |  |

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| --- | --- | --- | --- | --- | --- | --- |
| **Estimates of Fixed Effects**a |  |  |  |  |  |  |
| Parameter | Estimate | Std. Error | df | t | Sig. | 95% Confidence Interval |
| Lower Bound |
| Intercept | 41.622 | .359 | 176.258 | 115.846 | <.001 | 40.913 |
| hw2 | -.066 | .446 | 177.413 | -.149 | .882 | -.946 |
| mixgrd | -1.117 | .516 | 196.434 | -2.163 | .032 | -2.134 |
| CMverb10 | 3.187 | .399 | 171.550 | 7.981 | <.001 | 2.399 |
| WCverb | 2.361 | .079 | 123.603 | 30.055 | <.001 | 2.206 |
| mixgrd \* WCverb | .336 | .157 | 238.599 | 2.146 | .033 | .028 |
| mixgrd \* CMverb10 | .750 | .531 | 199.363 | 1.413 | .159 | -.297 |

|  |  |
| --- | --- |
| **Estimates of Fixed Effects**a |  |
| Parameter | 95% Confidence Interval |
| Upper Bound |
| Intercept | 42.331 |
| hw2 | .813 |
| mixgrd | -.099 |
| CMverb10 | 3.975 |
| WCverb | 2.517 |
| mixgrd \* WCverb | .645 |
| mixgrd \* CMverb10 | 1.797 |

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| a. Dependent Variable: langpost. |  |

**Covariance Parameters**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Estimates of Covariance Parameters**a |  |  |  |  |  |  |
| Parameter |  | Estimate | Std. Error | Wald Z | Sig. | 95% Confidence Interval |
|  | Lower Bound |
| Residual |  | 39.731 | .990 | 40.132 | <.001 | 37.838 |
| Intercept + WCverb [subject = schoolID] | UN (1,1) | 8.467 | 1.137 | 7.447 | <.001 | 6.508 |
| UN (2,1) | -.720 | .236 | -3.056 | .002 | -1.182 |
| UN (2,2) | .217 | .085 | 2.544 | .011 | .101 |

|  |  |  |
| --- | --- | --- |
| **Estimates of Covariance Parameters**a |  |  |
| Parameter |  | 95% Confidence Interval |
|  | Upper Bound |
| Residual |  | 41.720 |
| Intercept + WCverb [subject = schoolID] | UN (1,1) | 11.016 |
| UN (2,1) | -.258 |
| UN (2,2) | .470 |

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| a. Dependent Variable: langpost. |  |  |

**Custom Hypothesis Test 1 (Simple L2 context)**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Contrast Estimates**a,b |  |  |  |  |  |  |  |
| Contrast | Estimate | Std. Error | df | Test Value | t | Sig. | 95% Confidence Interval |
| Lower Bound |
| L1 | .825 | .405 | 181.620 | 0 | 2.036 | .043 | .026 |

|  |  |
| --- | --- |
| **Contrast Estimates**a,b |  |
| Contrast | 95% Confidence Interval |
| Upper Bound |
| L1 | 1.625 |

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| a. Simple L2 context |  |
| b. Dependent Variable: langpost. |  |

**Custom Hypothesis Test 2 (L2 context\*mixgrd)**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Contrast Estimates**a,b |  |  |  |  |  |  |  |
| Contrast | Estimate | Std. Error | df | Test Value | t | Sig. | 95% Confidence Interval |
| Lower Bound |
| L1 | .414 | .554 | 234.874 | 0 | .747 | .456 | -.677 |

|  |  |
| --- | --- |
| **Contrast Estimates**a,b |  |
| Contrast | 95% Confidence Interval |
| Upper Bound |
| L1 | 1.504 |

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| --- | --- |
| a. L2 context\*mixgrd |  |
| b. Dependent Variable: langpost. |  |

SPSS Model 5a: Hybrid with Unsmushed Intra-Variable Cross-Level Interaction

**Mixed Model Analysis**

|  |  |  |
| --- | --- | --- |
| **Notes** |  |  |
| Output Created |  | 23-SEP-2023 15:54:03 |
| Comments |  |  |
| Input | Active Dataset | Example |
| Filter | <none> |
| Weight | <none> |
| Split File | <none> |
| N of Rows in Working Data File | 3566 |
| Missing Value Handling | Definition of Missing | User-defined missing values are treated as valid data. |
| Cases Used | Statistics are based on all cases with valid data for all variables in the model. |
| Weight Handling |  | not applicable |
| Syntax |  | MIXED langpost BY schoolID WITH hw2 mixgrd CMverb10 verb10 WCverb /METHOD = REML /CRITERIA = DFMETHOD(SATTERTHWAITE) /PRINT = SOLUTION TESTCOV /FIXED = hw2 mixgrd CMverb10 verb10 mixgrd\*verb10 mixgrd\*CMverb10 CMverb10\*verb10 CMverb10\*CMverb10 /RANDOM = INTERCEPT WCverb | COVTYPE(UN) SUBJECT(schoolID) /TEST = "Simple L2 between" verb10 1 CMverb10 1 /TEST = "L2 between\*mixgrd" mixgrd\*verb10 1 mixgrd\*CMverb10 1 /TEST = "L2 between\*CMverbal" CMverb10\*verb10 1 CMverb10\*CMverb10 1. |
| Resources | Processor Time | 00:00:00.28 |
| Elapsed Time | 00:00:00.30 |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Model Dimension**a |  |  |  |  |
|  |  | Number of Levels | Covariance Structure | Number of Parameters |
| Fixed Effects | Intercept | 1 |  | 1 |
| hw2 | 1 |  | 1 |
| mixgrd | 1 |  | 1 |
| CMverb10 | 1 |  | 1 |
| verb10 | 1 |  | 1 |
| mixgrd \* verb10 | 1 |  | 1 |
| mixgrd \* CMverb10 | 1 |  | 1 |
| CMverb10 \* verb10 | 1 |  | 1 |
| CMverb10 \* CMverb10 | 1 |  | 1 |
| Random Effects | Intercept + WCverb | 2 | Unstructured | 3 |
| Residual |  |  |  | 1 |
| Total |  | 11 |  | 13 |

|  |  |  |
| --- | --- | --- |
| **Model Dimension**a |  |  |
|  |  | Subject Variables |
| Fixed Effects | Intercept |  |
| hw2 |  |
| mixgrd |  |
| CMverb10 |  |
| verb10 |  |
| mixgrd \* verb10 |  |
| mixgrd \* CMverb10 |  |
| CMverb10 \* verb10 |  |
| CMverb10 \* CMverb10 |  |
| Random Effects | Intercept + WCverb | schoolID |
| Residual |  |  |
| Total |  |  |

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| --- | --- | --- |
| a. Dependent Variable: langpost. |  |  |

|  |  |
| --- | --- |
| **Information Criteria**a |  |
| -2 Restricted Log Likelihood | 23587.80391264 |
| Akaike's Information Criterion (AIC) | 23595.80391264 |
| Hurvich and Tsai's Criterion (AICC) | 23595.81517390 |
| Bozdogan's Criterion (CAIC) | 23624.51060372 |
| Schwarz's Bayesian Criterion (BIC) | 23620.51060372 |

|  |  |
| --- | --- |
| The information criteria are displayed in smaller-is-better form.a |  |
| a. Dependent Variable: langpost. |  |

|  |  |  |
| --- | --- | --- |
| **Coefficients of Determination** |  |  |
| Pseudo-R Square Measures | Marginal | .377 |
| Conditional | .493 |

|  |  |  |
| --- | --- | --- |
| **Intraclass Correlation Coefficients** |  |  |
| Overall ICCs | Adjusted | .187 |
| Conditional | .116 |

**Fixed Effects**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Type III Tests of Fixed Effects**a |  |  |  |  |
| Source | Numerator df | Denominator df | F | Sig. |
| Intercept | 1 | 177.859 | 13289.559 | <.001 |
| hw2 | 1 | 175.423 | .024 | .878 |
| mixgrd | 1 | 196.083 | 2.606 | .108 |
| CMverb10 | 1 | 192.054 | 4.471 | .036 |
| verb10 | 1 | 122.866 | 890.002 | <.001 |
| mixgrd \* verb10 | 1 | 230.723 | 4.626 | .033 |
| mixgrd \* CMverb10 | 1 | 230.740 | .049 | .825 |
| CMverb10 \* verb10 | 1 | 179.286 | .309 | .579 |
| CMverb10 \* CMverb10 | 1 | 343.235 | 5.223 | .023 |

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| a. Dependent Variable: langpost. |  |  |  |  |

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| --- | --- | --- | --- | --- | --- | --- |
| **Estimates of Fixed Effects**a |  |  |  |  |  |  |
| Parameter | Estimate | Std. Error | df | t | Sig. | 95% Confidence Interval |
| Lower Bound |
| Intercept | 41.838 | .363 | 177.859 | 115.280 | <.001 | 41.122 |
| hw2 | -.067 | .437 | 175.423 | -.154 | .878 | -.929 |
| mixgrd | -.842 | .521 | 196.083 | -1.614 | .108 | -1.870 |
| CMverb10 | .859 | .406 | 192.054 | 2.115 | .036 | .058 |
| verb10 | 2.359 | .079 | 122.866 | 29.833 | <.001 | 2.202 |
| mixgrd \* verb10 | .339 | .158 | 230.723 | 2.151 | .033 | .028 |
| mixgrd \* CMverb10 | -.128 | .577 | 230.740 | -.222 | .825 | -1.266 |
| CMverb10 \* verb10 | -.043 | .078 | 179.286 | -.556 | .579 | -.197 |
| CMverb10 \* CMverb10 | -.382 | .167 | 343.235 | -2.285 | .023 | -.711 |

|  |  |
| --- | --- |
| **Estimates of Fixed Effects**a |  |
| Parameter | 95% Confidence Interval |
| Upper Bound |
| Intercept | 42.555 |
| hw2 | .795 |
| mixgrd | .187 |
| CMverb10 | 1.660 |
| verb10 | 2.515 |
| mixgrd \* verb10 | .650 |
| mixgrd \* CMverb10 | 1.009 |
| CMverb10 \* verb10 | .110 |
| CMverb10 \* CMverb10 | -.053 |

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| a. Dependent Variable: langpost. |  |

**Covariance Parameters**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Estimates of Covariance Parameters**a |  |  |  |  |  |  |
| Parameter |  | Estimate | Std. Error | Wald Z | Sig. | 95% Confidence Interval |
|  | Lower Bound |
| Residual |  | 39.718 | .989 | 40.146 | <.001 | 37.825 |
| Intercept + WCverb [subject = schoolID] | UN (1,1) | 8.321 | 1.131 | 7.358 | <.001 | 6.376 |
| UN (2,1) | -.857 | .245 | -3.503 | <.001 | -1.336 |
| UN (2,2) | .228 | .087 | 2.624 | .009 | .108 |

|  |  |  |
| --- | --- | --- |
| **Estimates of Covariance Parameters**a |  |  |
| Parameter |  | 95% Confidence Interval |
|  | Upper Bound |
| Residual |  | 41.705 |
| Intercept + WCverb [subject = schoolID] | UN (1,1) | 10.861 |
| UN (2,1) | -.378 |
| UN (2,2) | .482 |

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| --- | --- | --- |
| a. Dependent Variable: langpost. |  |  |

**Custom Hypothesis Test 1 (Simple L2 between)**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Contrast Estimates**a,b |  |  |  |  |  |  |  |
| Contrast | Estimate | Std. Error | df | Test Value | t | Sig. | 95% Confidence Interval |
| Lower Bound |
| L1 | 3.218 | .401 | 180.508 | 0 | 8.034 | <.001 | 2.428 |

|  |  |
| --- | --- |
| **Contrast Estimates**a,b |  |
| Contrast | 95% Confidence Interval |
| Upper Bound |
| L1 | 4.008 |

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| --- | --- |
| a. Simple L2 between |  |
| b. Dependent Variable: langpost. |  |

**Custom Hypothesis Test 2 (L2 between\*mixgrd)**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Contrast Estimates**a,b |  |  |  |  |  |  |  |
| Contrast | Estimate | Std. Error | df | Test Value | t | Sig. | 95% Confidence Interval |
| Lower Bound |
| L1 | .211 | .555 | 197.998 | 0 | .381 | .704 | -.883 |

|  |  |
| --- | --- |
| **Contrast Estimates**a,b |  |
| Contrast | 95% Confidence Interval |
| Upper Bound |
| L1 | 1.306 |

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| --- | --- |
| a. L2 between\*mixgrd |  |
| b. Dependent Variable: langpost. |  |

**Custom Hypothesis Test 3 (L2 between\*CMverbal)**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Contrast Estimates**a,b |  |  |  |  |  |  |  |
| Contrast | Estimate | Std. Error | df | Test Value | t | Sig. | 95% Confidence Interval |
| Lower Bound |
| L1 | -.425 | .149 | 232.434 | 0 | -2.860 | .005 | -.718 |

|  |  |
| --- | --- |
| **Contrast Estimates**a,b |  |
| Contrast | 95% Confidence Interval |
| Upper Bound |
| L1 | -.132 |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
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|  |  |  |  |  |  |  |  |

|  |  |
| --- | --- |
| a. L2 between\*CMverbal |  |
| b. Dependent Variable: langpost. |  |

SPSS Model 5b: Cluster-MC with Unsmushed Intra-Variable Cross-Level Interaction

**Mixed Model Analysis**

|  |  |  |
| --- | --- | --- |
| **Notes** |  |  |
| Output Created |  | 23-SEP-2023 15:54:03 |
| Comments |  |  |
| Input | Active Dataset | Example |
| Filter | <none> |
| Weight | <none> |
| Split File | <none> |
| N of Rows in Working Data File | 3566 |
| Missing Value Handling | Definition of Missing | User-defined missing values are treated as valid data. |
| Cases Used | Statistics are based on all cases with valid data for all variables in the model. |
| Weight Handling |  | not applicable |
| Syntax |  | MIXED langpost BY schoolID WITH hw2 mixgrd CMverb10 WCverb /METHOD = REML /CRITERIA = DFMETHOD(SATTERTHWAITE) /PRINT = SOLUTION TESTCOV /FIXED = hw2 mixgrd CMverb10 WCverb mixgrd\*WCverb mixgrd\*CMverb10 CMverb10\*WCverb CMverb10\*CMverb10 /RANDOM = INTERCEPT WCverb | COVTYPE(UN) SUBJECT(schoolID) /TEST = "Simple L2 context" WCverb -1 CMverb10 1 /TEST = "L2 context\*mixgrd" mixgrd\*WCverb -1 mixgrd\*CMverb10 1 /TEST = "L2 context\*CMverbal" CMverb10\*WCverb -1 CMverb10\*CMverb10 1. |
| Resources | Processor Time | 00:00:00.28 |
| Elapsed Time | 00:00:00.30 |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Model Dimension**a |  |  |  |  |
|  |  | Number of Levels | Covariance Structure | Number of Parameters |
| Fixed Effects | Intercept | 1 |  | 1 |
| hw2 | 1 |  | 1 |
| mixgrd | 1 |  | 1 |
| CMverb10 | 1 |  | 1 |
| WCverb | 1 |  | 1 |
| mixgrd \* WCverb | 1 |  | 1 |
| mixgrd \* CMverb10 | 1 |  | 1 |
| CMverb10 \* WCverb | 1 |  | 1 |
| CMverb10 \* CMverb10 | 1 |  | 1 |
| Random Effects | Intercept + WCverb | 2 | Unstructured | 3 |
| Residual |  |  |  | 1 |
| Total |  | 11 |  | 13 |

|  |  |  |
| --- | --- | --- |
| **Model Dimension**a |  |  |
|  |  | Subject Variables |
| Fixed Effects | Intercept |  |
| hw2 |  |
| mixgrd |  |
| CMverb10 |  |
| WCverb |  |
| mixgrd \* WCverb |  |
| mixgrd \* CMverb10 |  |
| CMverb10 \* WCverb |  |
| CMverb10 \* CMverb10 |  |
| Random Effects | Intercept + WCverb | schoolID |
| Residual |  |  |
| Total |  |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
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| --- | --- | --- |
| a. Dependent Variable: langpost. |  |  |

|  |  |
| --- | --- |
| **Information Criteria**a |  |
| -2 Restricted Log Likelihood | 23587.80391264 |
| Akaike's Information Criterion (AIC) | 23595.80391264 |
| Hurvich and Tsai's Criterion (AICC) | 23595.81517390 |
| Bozdogan's Criterion (CAIC) | 23624.51060372 |
| Schwarz's Bayesian Criterion (BIC) | 23620.51060372 |

|  |  |
| --- | --- |
| The information criteria are displayed in smaller-is-better form.a |  |
| a. Dependent Variable: langpost. |  |

|  |  |  |
| --- | --- | --- |
| **Coefficients of Determination** |  |  |
| Pseudo-R Square Measures | Marginal | .377 |
| Conditional | .493 |

|  |  |  |
| --- | --- | --- |
| **Intraclass Correlation Coefficients** |  |  |
| Overall ICCs | Adjusted | .187 |
| Conditional | .116 |

**Fixed Effects**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Type III Tests of Fixed Effects**a |  |  |  |  |
| Source | Numerator df | Denominator df | F | Sig. |
| Intercept | 1 | 177.859 | 13289.559 | <.001 |
| hw2 | 1 | 175.423 | .024 | .878 |
| mixgrd | 1 | 196.083 | 2.606 | .108 |
| CMverb10 | 1 | 180.508 | 64.552 | <.001 |
| WCverb | 1 | 122.866 | 890.002 | <.001 |
| mixgrd \* WCverb | 1 | 230.723 | 4.626 | .033 |
| mixgrd \* CMverb10 | 1 | 197.998 | .145 | .704 |
| CMverb10 \* WCverb | 1 | 179.286 | .309 | .579 |
| CMverb10 \* CMverb10 | 1 | 232.434 | 8.180 | .005 |

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| a. Dependent Variable: langpost. |  |  |  |  |

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| **Estimates of Fixed Effects**a |  |  |  |  |  |  |
| Parameter | Estimate | Std. Error | df | t | Sig. | 95% Confidence Interval |
| Lower Bound |
| Intercept | 41.838 | .363 | 177.859 | 115.280 | <.001 | 41.122 |
| hw2 | -.067 | .437 | 175.423 | -.154 | .878 | -.929 |
| mixgrd | -.842 | .521 | 196.083 | -1.614 | .108 | -1.870 |
| CMverb10 | 3.218 | .401 | 180.508 | 8.034 | <.001 | 2.428 |
| WCverb | 2.359 | .079 | 122.866 | 29.833 | <.001 | 2.202 |
| mixgrd \* WCverb | .339 | .158 | 230.723 | 2.151 | .033 | .028 |
| mixgrd \* CMverb10 | .211 | .555 | 197.998 | .381 | .704 | -.883 |
| CMverb10 \* WCverb | -.043 | .078 | 179.286 | -.556 | .579 | -.197 |
| CMverb10 \* CMverb10 | -.425 | .149 | 232.434 | -2.860 | .005 | -.718 |

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| **Estimates of Fixed Effects**a |  |
| Parameter | 95% Confidence Interval |
| Upper Bound |
| Intercept | 42.555 |
| hw2 | .795 |
| mixgrd | .187 |
| CMverb10 | 4.008 |
| WCverb | 2.515 |
| mixgrd \* WCverb | .650 |
| mixgrd \* CMverb10 | 1.306 |
| CMverb10 \* WCverb | .110 |
| CMverb10 \* CMverb10 | -.132 |

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| a. Dependent Variable: langpost. |  |

**Covariance Parameters**

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| **Estimates of Covariance Parameters**a |  |  |  |  |  |  |
| Parameter |  | Estimate | Std. Error | Wald Z | Sig. | 95% Confidence Interval |
|  | Lower Bound |
| Residual |  | 39.718 | .989 | 40.146 | <.001 | 37.825 |
| Intercept + WCverb [subject = schoolID] | UN (1,1) | 8.321 | 1.131 | 7.358 | <.001 | 6.376 |
| UN (2,1) | -.857 | .245 | -3.503 | <.001 | -1.336 |
| UN (2,2) | .228 | .087 | 2.624 | .009 | .108 |

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| **Estimates of Covariance Parameters**a |  |  |
| Parameter |  | 95% Confidence Interval |
|  | Upper Bound |
| Residual |  | 41.705 |
| Intercept + WCverb [subject = schoolID] | UN (1,1) | 10.861 |
| UN (2,1) | -.378 |
| UN (2,2) | .482 |

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| a. Dependent Variable: langpost. |  |  |

**Custom Hypothesis Test 1 (Simple L2 context)**

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| **Contrast Estimates**a,b |  |  |  |  |  |  |  |
| Contrast | Estimate | Std. Error | df | Test Value | t | Sig. | 95% Confidence Interval |
| Lower Bound |
| L1 | .859 | .406 | 192.054 | 0 | 2.115 | .036 | .058 |

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| **Contrast Estimates**a,b |  |
| Contrast | 95% Confidence Interval |
| Upper Bound |
| L1 | 1.660 |

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| a. Simple L2 context |  |
| b. Dependent Variable: langpost. |  |

**Custom Hypothesis Test 2 (L2 context\*mixgrd)**

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| **Contrast Estimates**a,b |  |  |  |  |  |  |  |
| Contrast | Estimate | Std. Error | df | Test Value | t | Sig. | 95% Confidence Interval |
| Lower Bound |
| L1 | -.128 | .577 | 230.740 | 0 | -.222 | .825 | -1.266 |

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| **Contrast Estimates**a,b |  |
| Contrast | 95% Confidence Interval |
| Upper Bound |
| L1 | 1.009 |

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| a. L2 context\*mixgrd |  |
| b. Dependent Variable: langpost. |  |

**Custom Hypothesis Test 3 (L2 context\*CMverbal)**

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| **Contrast Estimates**a,b |  |  |  |  |  |  |  |
| Contrast | Estimate | Std. Error | df | Test Value | t | Sig. | 95% Confidence Interval |
| Lower Bound |
| L1 | -.382 | .167 | 343.235 | 0 | -2.285 | .023 | -.711 |

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| **Contrast Estimates**a,b |  |
| Contrast | 95% Confidence Interval |
| Upper Bound |
| L1 | -.053 |

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| a. L2 context\*CMverbal |  |
| b. Dependent Variable: langpost. |  |