

# Multitudes v3 (2024/25) Prediction Models

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# 1 Preliminaries

## Cautionary Note

This document is WORK IN PROGRESS and will be updated as new data (e.g., additional demographic information, score database updates/fixes) become available.

## To Do

- ~~recompute scores for universal screening tasks with updated 2025 item parameters once available~~
- ~~filter out implausible RAN score~~
- ~~add 23/24 data~~
- ~~align grades between years~~
- ~~align tasknames between years~~
- ~~re-run 23/24 models~~
- ~~run 24/25 models~~
- ~~run combined model~~
- ~~run two-year prediction models (K-G2)~~
- ~~recompute scores for remaining tasks with updated 2025 item parameters once available~~
- ~~isolate pooled models (pooled coefficients) for English model evaluations with 24/25 data~~
- as per decision in data meeting on 2025-07-25
  - ~~use combined (23/24 and 24/25) data for Spanish model~~
  - ~~check ELPD distribution for English samples to determine whether to use combined or only 23/24 data for English models~~

## 2 ENGLISH MODELS

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### 2.1 Sample



Table 1: Demographic Characteristics of the English Model Building and Evaluation Samples by Grade

Characteristic	AY 23/24			AY 24/25		
	K N = 650	G1 N = 515	G2 N = 663	K N = 435	G1 N = 552	G2 N = 330
Gender						
Female	331 (51%)	240 (47%)	331 (50%)	180 (47%)	289 (55%)	144 (46%)
Male	319 (49%)	275 (53%)	330 (50%)	202 (53%)	233 (45%)	170 (54%)
Unknown	0	0	2	53	30	16
Race						
Asian	81 (13%)	65 (13%)	65 (9.9%)	24 (7.8%)	47 (9.6%)	33 (10%)
Black/African American	85 (14%)	53 (10%)	95 (14%)	41 (13%)	65 (13%)	40 (12%)
Not reported	136 (22%)	94 (18%)	134 (20%)	51 (17%)	100 (20%)	40 (12%)
Other	88 (15%)	71 (14%)	80 (12%)	34 (11%)	57 (12%)	34 (11%)
White	215 (36%)	229 (45%)	282 (43%)	159 (51%)	219 (45%)	175 (54%)
Unknown	45	3	7	126	64	8
Ethnicity						
Hispanic/Latin(o/a)	350 (55%)	255 (50%)	357 (54%)	295 (81%)	416 (77%)	228 (70%)
Not Hispanic/Latin(o/a)	289 (45%)	258 (50%)	301 (46%)	71 (19%)	124 (23%)	98 (30%)
Unknown	11	2	5	69	12	4
ELPD						
EL	146 (24%)	85 (17%)	117 (19%)	212 (59%)	238 (48%)	119 (38%)
EO	395 (66%)	379 (75%)	451 (72%)	123 (34%)	211 (43%)	155 (50%)
EP	37 (6.2%)	43 (8.5%)	55 (8.8%)	19 (5.2%)	37 (7.5%)	36 (12%)
TBD	20 (3.3%)	1 (0.2%)	1 (0.2%)	8 (2.2%)	10 (2.0%)	0 (0%)
Unknown	52	7	39	73	56	20
Ever IEP/504	43 (7.9%)	41 (9.1%)	56 (12%)	32 (9.2%)	33 (7.3%)	30 (10%)
Unknown	107	62	181	89	99	35
Home Language						
English	463 (72%)	391 (76%)	448 (72%)	156 (36%)	237 (44%)	170 (52%)
Other	63 (9.8%)	50 (9.8%)	62 (10.0%)	11 (2.6%)	16 (3.0%)	15 (4.6%)
Spanish	115 (18%)	71 (14%)	113 (18%)	261 (61%)	289 (53%)	140 (43%)
Unknown	9	3	40	7	10	5
Lg. of Instruction						
Bilingual Instruction	145 (22%)	85 (17%)	64 (9.7%)	124 (29%)	146 (27%)	95 (29%)
English Instruction	505 (78%)	430 (83%)	594 (90%)	306 (71%)	401 (73%)	232 (71%)
Unknown	0	0	5	5	5	3

## 2.2 Descriptives

### 2.2.1 Distributions of English Multitudes Tasks in Fall '23

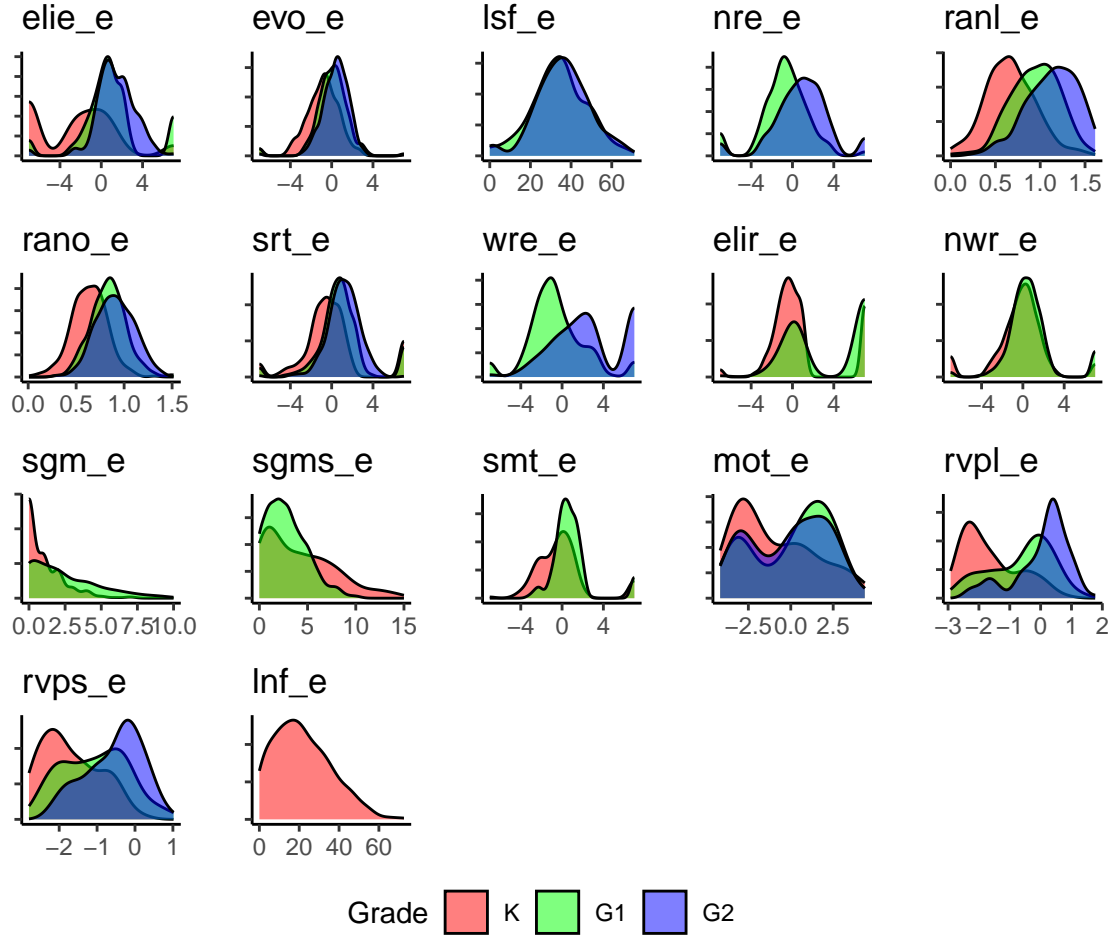


Figure 1: Distributions of English Multitudes Tasks by Grade (Fall '23)

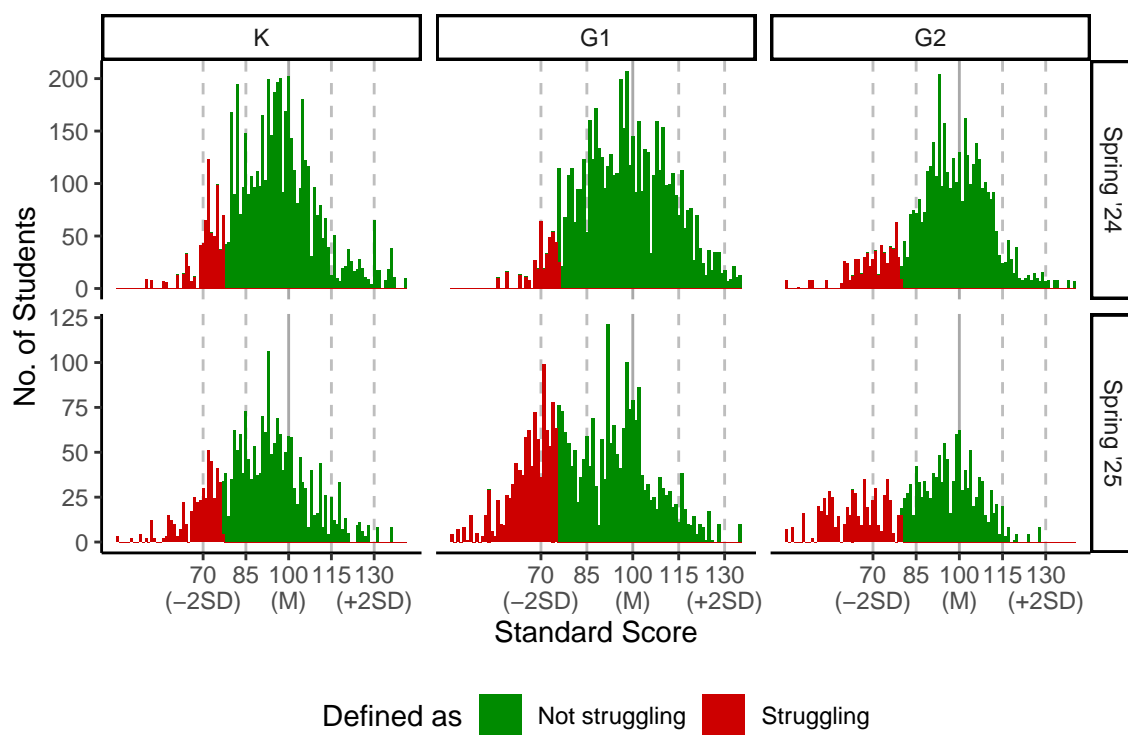


Figure 2: Distribution of Woodcock-Johnson Basic Reading Skills Cluster (for Kindergarten) Broad Reading Cluster (for Grades 1 and 2) by Grade and Language with Struggling Readers ( $\leq$  20th Percentile) Highlighted (Spring '24 and Spring '25).

### 2.2.2 Distributions of English Outcome Measures (Spring '24 and Spring '25)

Table 2: Comparison of Proportions of Struggling Readers ( $\leq$  20th Percentile) in the Study Sample Based on Overall Multitudes Sample and on Published Norms (Spring '24 and Spring '25).

Reference	Spring '24			Spring '25		
	K N = 650	G1 N = 515	G2 N = 663	K N = 435	G1 N = 552	G2 N = 330
Norm-based						
Not struggling	421 (65%)	372 (72%)	488 (74%)	228 (52%)	247 (45%)	192 (58%)
Struggling	229 (35%)	143 (28%)	175 (26%)	207 (48%)	305 (55%)	138 (42%)
Sample-based						
Not struggling	552 (85%)	472 (92%)	563 (85%)	332 (76%)	354 (64%)	229 (69%)
Struggling	98 (15%)	43 (8.3%)	100 (15%)	103 (24%)	198 (36%)	101 (31%)



## 2.3 LOGO Cross-validated Models (2023/24 Only)

Table 3: English-to-English Prediction Models Using Data from 2023/24 AY Only.

Grade	Predictors	All							EL							EO						
		n	Acc.	B.Acc.	Sens.	Spec.	Prev.	P.Prev.	n	Acc.	B.Acc.	Sens.	Spec.	Prev.	P.Prev.	n	Acc.	B.Acc.	Sens.	Spec.	Prev.	P.Prev.
K	LNF only	638	0.7365	0.6907	0.625	0.7564	0.151	0.301	164	0.6743	0.6779	0.6842	0.6715	0.217	0.406	402	0.755	0.6941	0.6111	0.7771	0.134	0.275
K	LNF, RANO, ELIR	638	0.6565	0.7067	0.7788	0.6346	0.151	0.428	164	0.56	0.6619	0.8421	0.4818	0.217	0.589	402	0.6807	0.7296	0.7963	0.6629	0.134	0.398
K	LNF, RANO, ELIR, EVO	638	0.6754	0.71	0.7596	0.6604	0.151	0.403	164	0.56	0.6714	0.8684	0.4745	0.217	0.600	402	0.7129	0.7247	0.7407	0.7086	0.134	0.352
K	LNF, RANO, EVO	638	0.7132	0.7402	0.7788	0.7015	0.151	0.371	164	0.5943	0.6933	0.8684	0.5182	0.217	0.566	402	0.75	0.7539	0.7593	0.7486	0.134	0.319
G1	WRE only	508	0.688	0.7779	0.8864	0.6695	0.085	0.378	85	0.593	0.6891	0.8182	0.56	0.128	0.488	373	0.7024	0.7957	0.9091	0.6824	0.088	0.370
G1	WRE, EVO	508	0.6996	0.8049	0.9318	0.678	0.085	0.374	85	0.5698	0.7145	0.9091	0.52	0.128	0.535	373	0.7185	0.8182	0.9394	0.6971	0.088	0.359
G1	WRE, RANO	508	0.7054	0.7772	0.8636	0.6907	0.085	0.357	85	0.593	0.6891	0.8182	0.56	0.128	0.488	373	0.7265	0.7953	0.8788	0.7118	0.088	0.340
G1	WRE, RANO, EVO	508	0.7035	0.8173	0.9545	0.6801	0.085	0.374	85	0.5698	0.7533	1	0.5067	0.128	0.558	373	0.7265	0.8226	0.9394	0.7059	0.088	0.351
G1	WRE, RANO, LSF	508	0.7481	0.8211	0.9091	0.7331	0.085	0.322	85	0.6628	0.7291	0.8182	0.64	0.128	0.419	373	0.7614	0.8418	0.9394	0.7441	0.088	0.316
G1	WRE, RANO, LSF, EVO	508	0.7578	0.847	0.9545	0.7394	0.085	0.320	85	0.6512	0.8	1	0.6	0.128	0.477	373	0.7775	0.8506	0.9394	0.7618	0.088	0.300
G2	WRE only	653	0.8714	0.9077	0.96	0.8553	0.153	0.270	116	0.7931	0.8463	0.9697	0.7229	0.284	0.474	445	0.8787	0.916	0.9677	0.8642	0.139	0.252
G2	WRE, RANL	653	0.8959	0.9303	0.98	0.8807	0.153	0.251	116	0.8276	0.8704	0.9697	0.7711	0.284	0.440	445	0.9034	0.9439	1	0.8877	0.139	0.236
G2	WRE, RANL, EVO	653	0.8836	0.9067	0.94	0.8734	0.153	0.251	116	0.7931	0.8372	0.9394	0.7349	0.284	0.457	445	0.8989	0.9345	0.9839	0.8851	0.139	0.236

Note. green:  $\geq .8$ ; black:  $\geq .7$ ; yellow:  $\geq .6$ ; red otherwise

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## 2.4 LOGO Cross-validated Models (2023/24 and 2024/25 Combined)

Table 4: English-to-English Prediction Models Using Data from Both 2023/24 and 2024/25 AYs.

Grade	Predictors	All							EL							EO						
		n	Acc.	B.Acc.	Sens.	Spec.	Prev.	P.Prev.	n	Acc.	B.Acc.	Sens.	Spec.	Prev.	P.Prev.	n	Acc.	B.Acc.	Sens.	Spec.	Prev.	P.Prev.
K	LNF only	1059	0.787	0.7298	0.639	0.8206	0.185	0.264	376	0.7468	0.7439	0.7379	0.75	0.266	0.380	525	0.8178	0.7052	0.5443	0.8661	0.150	0.195
K	LNF, RANO, ELIR	1059	0.7563	0.7374	0.7073	0.7674	0.185	0.320	376	0.7003	0.7339	0.8058	0.662	0.266	0.462	525	0.7989	0.7253	0.6203	0.8304	0.150	0.237
K	LNF, RANO, ELIR, EVO	1059	0.7112	0.7436	0.7951	0.6921	0.185	0.398	376	0.6589	0.7367	0.9029	0.5704	0.266	0.556	525	0.7514	0.7235	0.6835	0.7634	0.150	0.304
K	LNF, RANO, EVO	1059	0.7067	0.7484	0.8146	0.6822	0.185	0.410	376	0.6408	0.7243	0.9029	0.5458	0.266	0.574	525	0.759	0.7384	0.7089	0.7679	0.150	0.304
G1	WRE only	1057	0.827	0.8461	0.8817	0.8106	0.231	0.350	339	0.7972	0.8151	0.9021	0.7281	0.397	0.522	594	0.8191	0.8288	0.8427	0.815	0.149	0.283
G1	WRE, EVO	1057	0.8014	0.8241	0.8664	0.7819	0.231	0.368	339	0.7472	0.7736	0.9021	0.6452	0.397	0.572	594	0.809	0.8044	0.7978	0.811	0.149	0.280
G1	WRE, RANO	1057	0.8111	0.8224	0.8435	0.8014	0.231	0.348	339	0.7833	0.7988	0.8741	0.7235	0.397	0.514	594	0.809	0.7998	0.7865	0.813	0.149	0.276
G1	WRE, RANO, EVO	1057	0.8076	0.8322	0.8779	0.7865	0.231	0.367	339	0.75	0.7771	0.9091	0.6452	0.397	0.575	594	0.8157	0.813	0.809	0.8169	0.149	0.276
G1	WRE, RANO, LSF	1057	0.8041	0.8272	0.8702	0.7842	0.231	0.367	339	0.75	0.77	0.8671	0.6728	0.397	0.542	594	0.8208	0.8344	0.8539	0.815	0.149	0.285
G1	WRE, RANO, LSF, EVO	1057	0.8226	0.8299	0.8435	0.8163	0.231	0.336	339	0.7861	0.7975	0.8531	0.7419	0.397	0.494	594	0.8325	0.8182	0.7978	0.8386	0.149	0.256
G2	WRE only	974	0.8787	0.8942	0.9204	0.868	0.203	0.292	244	0.8623	0.8819	0.9375	0.8263	0.324	0.421	595	0.879	0.8941	0.9182	0.8701	0.185	0.276
G2	WRE, RANL	974	0.8999	0.9149	0.9403	0.8896	0.203	0.279	244	0.8704	0.8879	0.9375	0.8383	0.324	0.413	595	0.9025	0.9226	0.9545	0.8907	0.185	0.266
G2	WRE, RANL, EVO	974	0.8888	0.9024	0.9254	0.8794	0.203	0.284	244	0.8462	0.8699	0.9375	0.8024	0.324	0.437	595	0.8975	0.909	0.9273	0.8907	0.185	0.260

Note. green:  $\geq .8$ ; black:  $\geq .7$ ; yellow:  $\geq .6$ ; red otherwise

## 2.5 Application to MV2 data (23/24 Only)

Table 5: Predicted Prevalence of Risk in MV2 Sample (ALL Data Collected in Fall 2024) for English Models Using 23/24 Data Only.

Grade	Predictors	n	P.Prev.
K	0. LNF only	2122	0.227144203581527
K	1. LNF, RANO, ELIR, EVO	1869	0.304975922953451
K	2. LNF, RANO, EVO	1887	0.250132485426603
K	3. LNF, RANO, ELIR	1994	0.288365095285858
G1	0. WRE only	2368	0.34375
G1	1. WRE, RANO, LSF, EVO	2178	0.378787878787879
G1	2. WRE, RANO, LSF	2320	0.381034482758621
G1	3. WRE, RANO	2327	0.474430597335625
G1	4. WRE, RANO, EVO	2184	0.416666666666667
G1	5. WRE, EVO	2193	0.412220702234382
G2	0. WRE only	2274	0.405452946350044
G2	1. WRE, RANL, EVO	2180	0.310091743119266
G2	2. WRE, RANL	2237	0.357174787662047

## 2.6 Application to MV2 data (23/24 and 24/25 Combined)

Table 6: Predicted Prevalence of Risk in MV2 Sample (ALL Data Collected in Fall 2024) for English Models Using Combined 23/24 and 24/25 Data

Grade	Predictors	n	P.Prev.
K	LNF only	2122	0.210650329877474
K	LNF, RANO, ELIR	1994	0.243731193580742
K	LNF, RANO, ELIR, EVO	1869	0.2776886035313
K	LNF, RANO, EVO	1887	0.280339162692104
G1	WRE only	2368	0.331925675675676
G1	WRE, EVO	2193	0.344733242134063
G1	WRE, RANO	2327	0.31972496776966
G1	WRE, RANO, EVO	2184	0.313644688644689
G1	WRE, RANO, LSF	2320	0.344396551724138
G1	WRE, RANO, LSF, EVO	2178	0.311753902662994
G2	WRE only	2274	0.319700967458223
G2	WRE, RANL	2237	0.316048278945016
G2	WRE, RANL, EVO	2180	0.31651376146789

### 3 SPANISH MODELS

#### 3.1 Sample

Table 7: Demographic Characteristics of the Sample for the Spanish Prediction Model (N = 979) by Grade

Characteristic	K N = 407	G1 N = 308	G2 N = 257
Gender			
Female	181 (49%)	153 (53%)	140 (55%)
Male	189 (51%)	136 (47%)	116 (45%)
Unknown	37	19	1
Race			
Asian	11 (3.4%)	7 (2.6%)	6 (2.4%)
Black/African American	2 (0.6%)	0 (0%)	1 (0.4%)
Not reported	191 (60%)	134 (49%)	119 (48%)
Other	22 (6.9%)	20 (7.3%)	7 (2.8%)
White	93 (29%)	113 (41%)	116 (47%)
Unknown	88	34	8
Ethnicity			
Hispanic/Latin(o/a)	373 (96%)	295 (96%)	242 (95%)
Not Hispanic/Latin(o/a)	17 (4.4%)	11 (3.6%)	14 (5.5%)
Unknown	17	2	1
ELPD			
EL	321 (83%)	236 (80%)	186 (74%)
EO	15 (3.9%)	13 (4.4%)	26 (10%)
EP	48 (12%)	46 (16%)	38 (15%)
TBD	5 (1.3%)	1 (0.3%)	1 (0.4%)
Unknown	18	12	6
Ever IEP/504	31 (9.0%)	22 (8.8%)	13 (6.0%)
Unknown	61	58	39
Home Language			
English	33 (8.2%)	18 (5.9%)	29 (12%)
Other	4 (1.0%)	1 (0.3%)	2 (0.8%)
Spanish	365 (91%)	287 (94%)	219 (88%)
Unknown	5	2	7

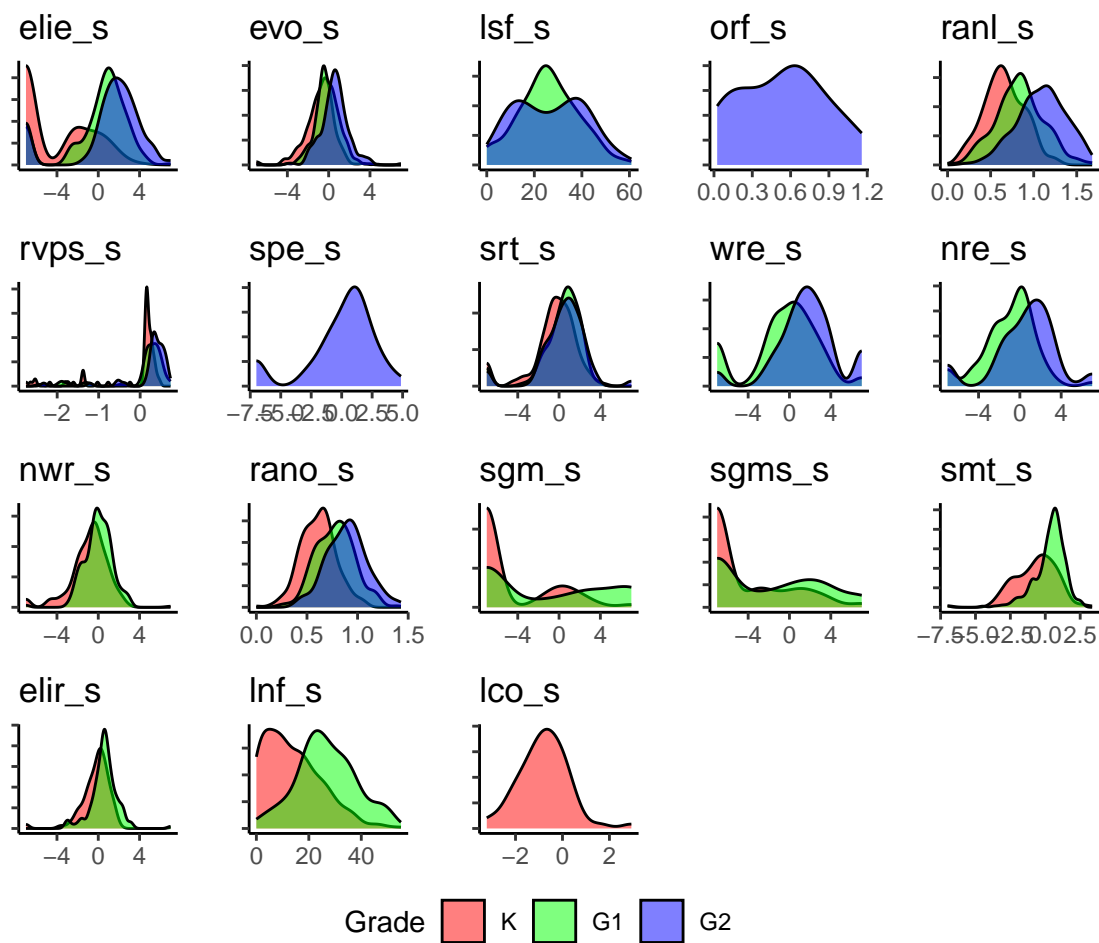


Figure 3: Distributions of Spanish Multitudes Tasks by Grade (Fall '23 & Fall '24 Combined)

## 3.2 Descriptives

### 3.2.1 Distributions of Spanish Multitudes Tasks

### 3.2.2 Distributions of Spanish Outcome Measures

Table 8: Comparison of Proportions of Struggling Readers ( $\leq$  20th Percentile) in the Study Sample Based on Overall Multitudes Sample and on Norms (Spring 2024).

<b>Reference</b>	<b>K</b> N = 407	<b>G1</b> N = 308	<b>G2</b> N = 257
Norm-based			
Not struggling	191 (47%)	178 (58%)	138 (54%)
Struggling	216 (53%)	130 (42%)	119 (46%)
Sample-based			
Not struggling	328 (81%)	234 (76%)	194 (75%)
Struggling	79 (19%)	74 (24%)	63 (25%)

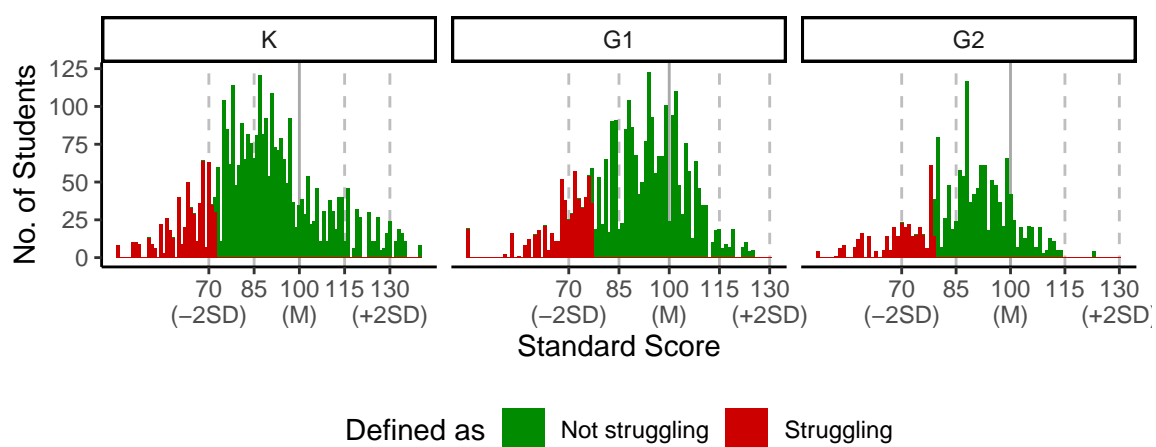


Figure 4: Distribution of Woodcock-Muñoz Basic Reading Skills Cluster (for Kindergarten) Broad Reading Cluster (for Grades 1 and 2) by Grade and Language with Struggling Readers ( $\leq$  20th Percentile) Highlighted (Spring '24 and Spring '25 Combined).

### 3.3 LOGO Cross-validated Models

Table 9: Spanish-to-Spanish Prediction Models Using Data from Both 2023/24 and 2024/25 AYs.

Grade	Predictors	All						
		n	Acc.	B.Acc.	Sens.	Spec.	Prev.	P.Prev.
K	LNF only	407	0.6413	0.6717	0.7215	0.622	0.194	0.445
K	LNF, RANO, ELIR	407	0.6708	0.6852	0.7089	0.6616	0.194	0.410
K	LNF, RANO, ELIR, EVO	407	0.6929	0.6797	0.6582	0.7012	0.194	0.369
K	LNF, RANO, EVO	407	0.7002	0.6651	0.6076	0.7226	0.194	0.342
G1	WRE only	308	0.7825	0.8384	0.9459	0.7308	0.240	0.432
G1	WRE, RANO, LSF	308	0.8636	0.8594	0.8514	0.8675	0.240	0.305
G1	WRE, RANO, LSF, EVO	308	0.8701	0.8637	0.8514	0.8761	0.240	0.299
G2	WRE only	241	0.8755	0.8688	0.8548	0.8827	0.257	0.307
G2	WRE, RANL	241	0.8548	0.8548	0.8548	0.8547	0.257	0.328
G2	WRE, RANL, EVO	241	0.8672	0.8632	0.8548	0.8715	0.257	0.315

Note. green:  $\geq .8$ ; black:  $\geq .7$ ; yellow:  $\geq .6$ ; red otherwise

### 3.4 Application to MV2 data (Combined 23/24 and 24/25)

Table 10: Predicted Prevalence of Risk in MV2 Sample (ALL Data Collected in Fall 2024) for Spanish Models.

Grade	Predictors	n	P.Prev.
K	LNF only	672	0.474702380952381
K	LNF, RANO, ELIR	539	0.452690166975881
K	LNF, RANO, ELIR, EVO	538	0.444237918215613
K	LNF, RANO, EVO	546	0.395604395604396
G1	WRE only	597	0.597989949748744
G1	WRE, RANO, LSF	515	0.611650485436893
G1	WRE, RANO, LSF, EVO	515	0.613592233009709
G2	WRE only	377	0.543766578249337
G2	WRE, RANL	358	0.525139664804469
G2	WRE, RANL, EVO	357	0.549019607843137