

# 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

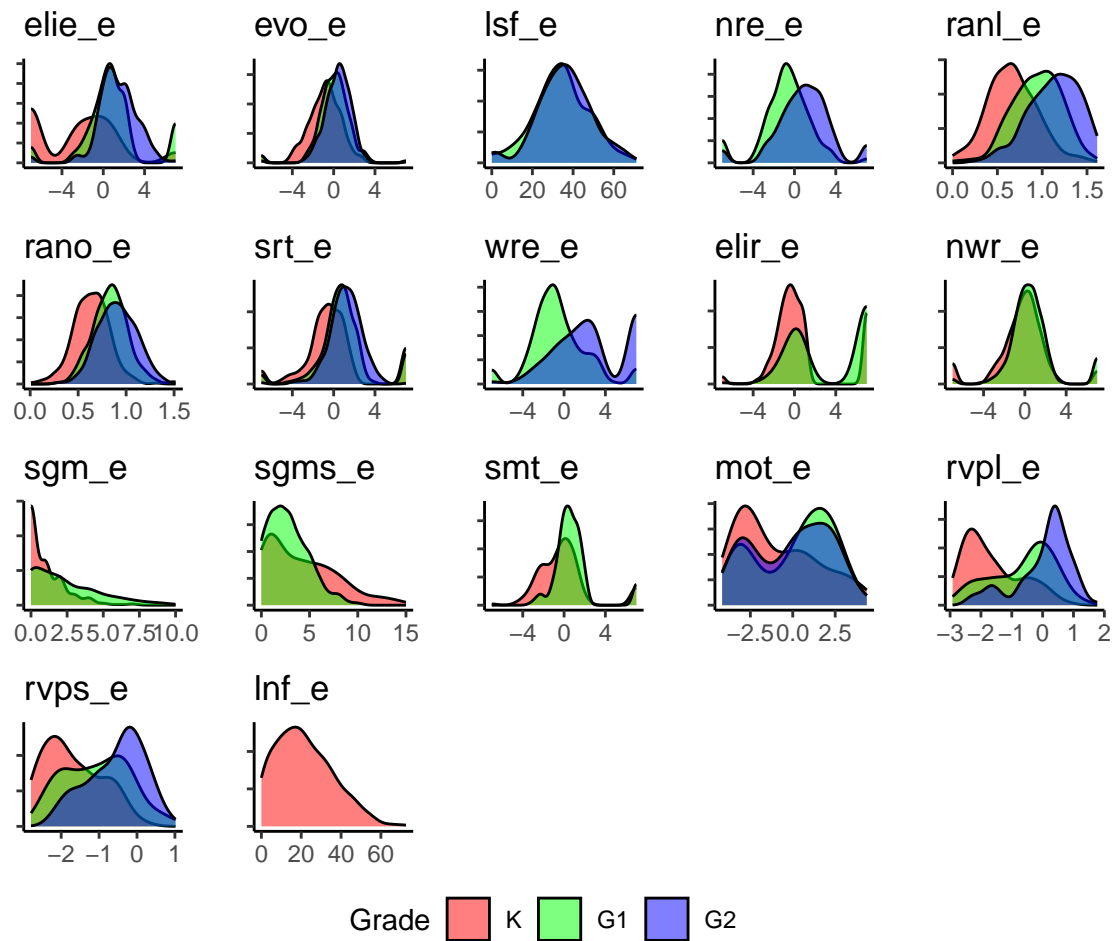


Figure 1: Distributions of English Multitudes Tasks by Grade (Fall '23)

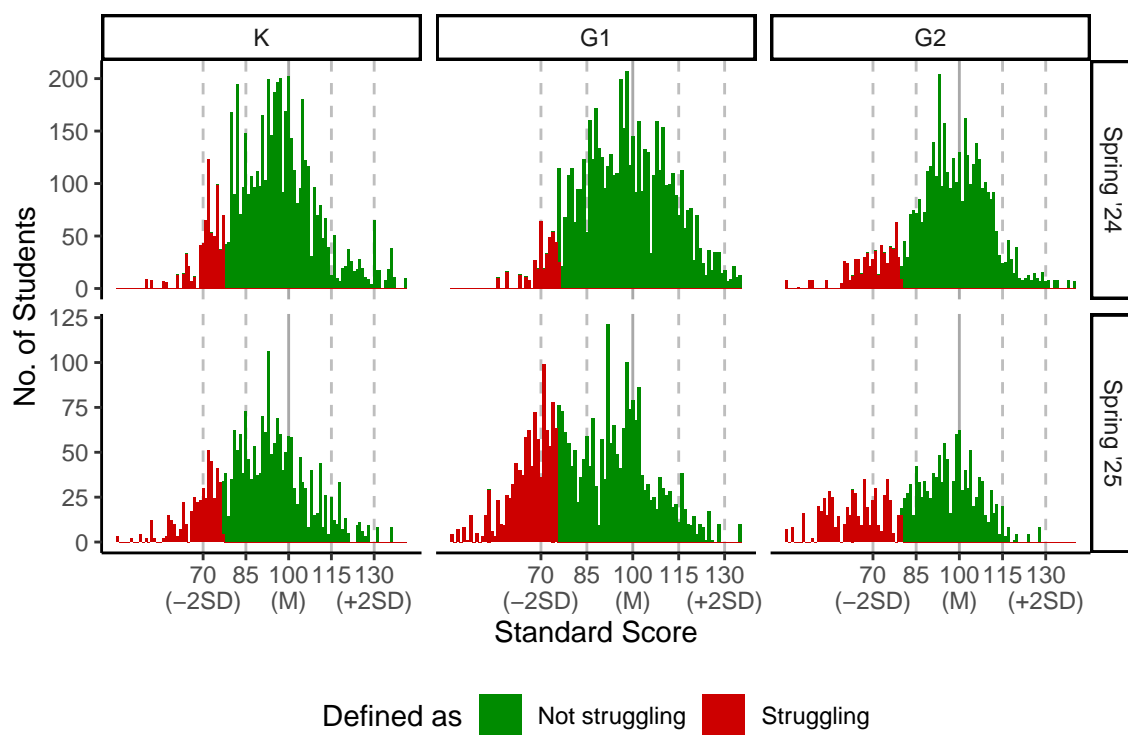


Figure 2: Distribution of Woodcock-Johnson Basic Reading Skills Cluster (for Kindergarten) Broad Reading Cluster (for Grades 1 and 2) by Grade and Language with Struggling Readers ( $\leq$  20th Percentile) Highlighted (Spring '24 and Spring '25).

### 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	0.7816	0.7416	0.678	0.8051	0.185	0.284	376	0.7235	0.7405	0.7767	0.7042	0.266	0.424	525	0.8083	0.7048	0.557	0.8527	0.150	0.209
K	LNF, RANO, ELIR	1059	0.7708	0.7255	0.6537	0.7973	0.185	0.286	376	0.708	0.7206	0.7476	0.6937	0.266	0.424	525	0.7989	0.6992	0.557	0.8415	0.150	0.218
K	LNF, RANO, ELIR, EVO	1059	0.722	0.7352	0.7561	0.7143	0.185	0.373	376	0.6486	0.7234	0.8835	0.5634	0.266	0.556	525	0.759	0.6967	0.6076	0.7857	0.150	0.273
K	LNF, RANO, EVO	1059	0.731	0.7445	0.7659	0.7231	0.185	0.367	376	0.6589	0.7274	0.8738	0.581	0.266	0.540	525	0.7704	0.7138	0.6329	0.7946	0.150	0.269
G1	WRE only	1057	0.8535	0.8367	0.8053	0.868	0.231	0.288	339	0.8028	0.8054	0.8182	0.7926	0.397	0.450	594	0.8643	0.8183	0.7528	0.8839	0.149	0.211
G1	WRE, EVO	1057	0.8032	0.8199	0.8511	0.7887	0.231	0.359	339	0.7583	0.7817	0.8951	0.6682	0.397	0.556	594	0.8074	0.7941	0.7753	0.813	0.149	0.275
G1	WRE, RANO	1057	0.8014	0.8241	0.8664	0.7819	0.231	0.368	339	0.7722	0.7944	0.9021	0.6866	0.397	0.547	594	0.8074	0.808	0.809	0.8071	0.149	0.285
G1	WRE, RANO, EVO	1057	0.8155	0.8213	0.8321	0.8106	0.231	0.338	339	0.7722	0.7872	0.8601	0.7143	0.397	0.514	594	0.8208	0.802	0.7753	0.8287	0.149	0.261
G1	WRE, RANO, LSF	1057	0.8455	0.8488	0.855	0.8427	0.231	0.319	339	0.8167	0.8253	0.8671	0.7834	0.397	0.475	594	0.8509	0.8336	0.809	0.8583	0.149	0.241
G1	WRE, RANO, LSF, EVO	1057	0.8641	0.8516	0.8282	0.8749	0.231	0.288	339	0.8306	0.8356	0.8601	0.8111	0.397	0.456	594	0.871	0.8223	0.7528	0.8917	0.149	0.204
G2	WRE only	974	0.8544	0.8901	0.9502	0.8299	0.203	0.329	244	0.8016	0.85	0.9875	0.7126	0.324	0.514	595	0.8672	0.894	0.9364	0.8515	0.185	0.294
G2	WRE, RANL	974	0.8847	0.9054	0.9403	0.8706	0.203	0.294	244	0.8381	0.8672	0.95	0.7844	0.324	0.453	595	0.8958	0.915	0.9455	0.8845	0.185	0.269
G2	WRE, RANL, EVO	974	0.8918	0.9062	0.9303	0.882	0.203	0.283	244	0.8502	0.8762	0.95	0.8024	0.324	0.441	595	0.9008	0.9146	0.9364	0.8928	0.185	0.260

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

### 3 SPANISH MODELS

#### 3.1 Sample

Table 5: 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

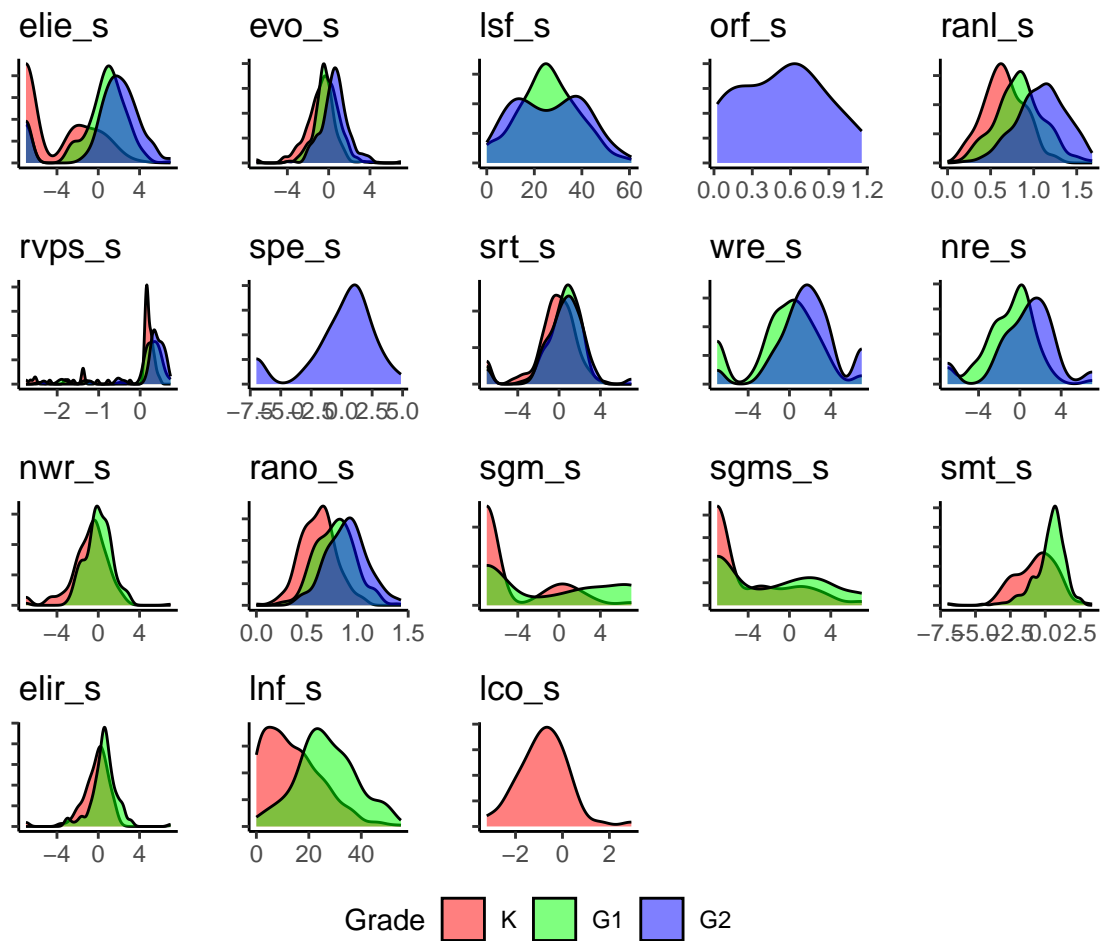


Figure 3: Distributions of Spanish Multitudes Tasks by Grade (Fall '23 & Fall '24 Combined)

## 3.2 Descriptives

### 3.2.1 Distributions of Spanish Multitudes Tasks

### 3.2.2 Distributions of Spanish Outcome Measures

Table 6: Comparison of Proportions of Struggling Readers ( $\leq$  20th Percentile) in the Study Sample Based on Overall Multitudes Sample and on Norms (Spring 2024).

Reference	K N = 407	G1 N = 308	G2 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%)

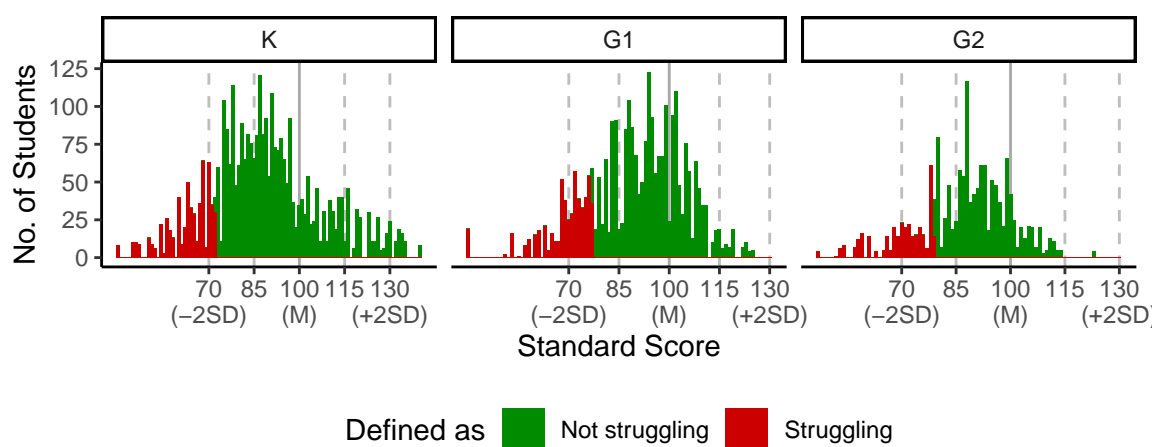


Figure 4: Distribution of Woodcock-Muñoz Basic Reading Skills Cluster (for Kindergarten) Broad Reading Cluster (for Grades 1 and 2) by Grade and Language with Struggling Readers ( $\leq$  20th Percentile) Highlighted (Spring '24 and Spring '25 Combined).

### 3.3 LOGO Cross-validated Models

Table 7: 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