Table A1: Language Sea: Persisting to Hard-Quit

Covariate	Hazard Ratio	95% CI
1 Seq error vs. No error	1.812	[1.626 , 2.019]
2 Seq errors vs. No error	1.907	[1.676 , 2.170]
3 Seq errors vs. No error	1.517	[1.279 , 1.798]
$>$ 3 Seq errors vs. No error	1.956	[1.620 , 2.361]
Fast error vs. No error	1.937	[1.730 , 2.169]
Slow error vs. No error	1.183	[1.061 , 1.319]
During school vs. Outside school	3.231	[2.790 , 3.741]
High diff vs. Medium diff	1.216	[1.112 , 1.330]
High diff vs. Low diff	1.028	[0.927 , 1.140]
Higer grades vs. Lower grades	1.348	[1.250 , 1.453]
Girls vs. Boys	0.919	[0.853 , 0.991]

Table A2: Language Sea: Persisting to Soft-Quit

Covariate	Hazard Ratio	95% CI
1 Seq error vs. No error	2.962	[2.736 , 3.207]
2 Seq errors vs. No error	4.699	[4.318 , 5.115]
3 Seq errors vs. No error	10.221	[9.410 , 11.101]
$>$ 3 Seq errors vs. No error	6.52	[5.888 , 7.220]
Fast error vs. No error	3.387	[3.160 , 3.631]
Slow error vs. No error	1.014	[0.941 , 1.092]
During school vs. Outside school	1.372	[1.283 , 1.467]
High diff vs. Medium diff	1.195	[1.127 , 1.266]
High diff vs. Low diff	1.123	[1.052 , 1.199]
Higer grades vs. Lower grades	1.288	[1.228 , 1.350]
Girls vs. Boys	0.98	[0.935 , 1.027]

Table A3: Math Garden: Persisting to Hard-Quit

Covariate	Hazard Ratio	95% CI
1 Seq error vs. No error	2.493	[2.345 , 2.649]
2 Seq errors vs. No error	2.699	[2.501 , 2.913]
3 Seq errors vs. No error	2.038	[1.829 , 2.271]
$>$ 3 Seq errors vs. No error	1.989	[1.748 , 2.265]
Fast error vs. No error	2.064	[1.932 , 2.205]
Slow error vs. No error	1.013	[0.951 , 1.078]
During school vs. Outside school	2.584	[2.344 , 2.848]
High diff vs. Medium diff	1.032	[0.971 , 1.097]
High diff vs. Low diff	1.082	[1.019 , 1.149]
Higer grades vs. Lower grades	1.252	[1.197 , 1.309]
Girls vs. Boys	0.893	[0.854 , 0.934]

Table A4: Math Garden: Persisting to Soft-Quit

Covariate	Hazard Ratio	95% CI
1 Seq error vs. No error	4.666	[4.455 , 4.887]
2 Seq errors vs. No error	7.768	[7.386 , 8.171]
3 Seq errors vs. No error	13.341	[12.652 , 14.068]
$>$ 3 Seq errors vs. No error	8.462	[7.923 , 9.039]
Fast error vs. No error	3.092	[2.969 , 3.220]
Slow error vs. No error	0.846	[0.811 , 0.882]
During school vs. Outside school	1.39	[1.321 , 1.462]
High diff vs. Medium diff	1.093	[1.049 , 1.138]
High diff vs. Low diff	1.215	[1.167 , 1.265]
Higer grades vs. Lower grades	1.324	[1.285 , 1.364]
Girls vs. Boys	1.021	[0.990 , 1.052]

B Supplementary Material: 2-State Markov Model

Table B1: Main effects

	Training Data		Testing Data	
	HR	95% CI	HR	95% CI
1 vs. 0 Sequential Errors	7.36	[7.09 ; 7.65]	8.20	[7.89 ; 8.53]
2 vs. 0 Sequential Errors	22.93	[22.02 ; 23.87]	23.39	[22.44 ; 24.38]
3 vs. 0 Sequential Errors	17.61	[16.50 ; 18.79]	19.99	[18.71 ; 21.36]
>3 vs. 0 Sequential Errors	17.65	[16.26 ; 19.17]	17.92	[16.43 ; 19.54]
Fast vs. Slow Response Time	0.95	[0.94 ; 0.97]	0.93	[0.92 ; 0.94]
During vs. Outside School Hours	1.60	[1.56 ; 1.64]	1.61	[1.57 ; 1.65]
Grade 5-6 vs. Grade 7-8	1.13	[1.11 ; 1.15]	1.26	[1.23 ; 1.28]
Grade 3-4 vs. Grade 7-8	1.44	[1.42 ; 1.47]	1.55	[1.52 ; 1.58]
Easy vs. Medium Difficulty Level	1.05	[1.03 ; 1.07]	1.02	[1.00 ; 1.04]
Difficult vs. Medium Difficulty Level	1.08	[1.07 ; 1.10]	1.10	[1.08 ; 1.12]

Note. 95% confidence intervals are computed using normal approximation methods, assuming normality of the log effect. HR = Hazard Ratio.

Table B2: Interaction Effects

	Training Data		Testing Data	
	HR	95% CI	HR	95% CI
1 SE * Fast RT	0.95	[0.93 ; 0.97]	0.97	[0.95 ; 0.98]
2 SE * Fast RT	1.52	[1.49 ; 1.55]	1.52	[1.49 ; 1.55]
3 SE * Fast RT	1.51	[1.46 ; 1.55]	1.48	[1.44 ; 1.52]
>3 SE * Fast RT	1.35	[1.30 ; 1.40]	1.36	[1.31 ; 1.42]
1 SE * Easy Level	1.02	[0.99 ; 1.04]	1.01	[0.99 ; 1.03]
2 SE * Easy Level	1.14	[1.11 ; 1.17]	1.20	[1.17 ; 1.24]
3 SE * Easy Level	1.15	[1.10 ; 1.21]	1.21	[1.15 ; 1.27]
>3 SE * Easy Level	1.12	[1.05 ; 1.20]	1.23	[1.15 ; 1.31]
1 SE* Difficult Level	0.82	[0.81 ; 0.84]	0.81	[0.79 ; 0.82]
2 SE * Difficult Level	0.95	[0.93 ; 0.97]	0.91	[0.89 ; 0.93]
3 SE * Difficult Level	0.88	[0.85 ; 0.91]	0.89	[0.86 ; 0.92]
>3 SE * Difficult Level	0.90	[0.86 ; 0.93]	0.93	[0.89 ; 0.97]
1 SE* Grade 3-4	1.31	[1.28 ; 1.34]	1.21	[1.18 ; 1.24]
2 SE * Grade 3-4	0.78	[0.76 ; 0.80]	0.71	[0.70 ; 0.73]
3 SE * Grade 3-4	0.91	[0.87 ; 0.95]	0.82	[0.79 ; 0.85]
>3 SE * Grade 3-4	0.98	[0.94 ; 1.04]	0.87	[0.82 ; 0.91]
1 SE * Grade 5-6	1.13	[1.10 ; 1.16]	1.03	[1.00 ; 1.06]
2 SE * Grade 5-6	0.89	[0.86 ; 0.91]	0.80	[0.77 ; 0.82]
3 SE * Grade 5-6	0.97	[0.92 ; 1.01]	0.85	[0.81 ; 0.89]
>3 SE * Grade 5-6	1.00	[0.94 ; 1.06]	0.89	[0.84 ; 0.95]
1 SE * During School Hours	1.01	[0.97 ; 1.04]	0.98	[0.95 ; 1.01]
2 SE * During School Hours	0.72	[0.69 ; 0.74]	0.77	[0.74 ; 0.80]
3 SE * During School Hours	0.80	[0.76 ; 0.85]	0.77	[0.73 ; 0.82]
>3 SE * During School Hours	0.68	[0.64 ; 0.73]	0.73	[0.68 ; 0.79]

Note. 95% confidence intervals are computed using normal approximation methods, assuming normality of the log effect. HR = Hazard Ratio; SE = Sequential Error; RT = Respone time.

Table B3: Markov Model Model Fit Indices

	Training Data		Testing Data	
Model	AIC	-2Log-Likelihood	AIC	-2Log-Likelihood
Baseline	2904426	2904424	2848467	2848465
Covariate	2371495	2371473	2383331	2383309
Interaction	2364586	2364516	2375501	2375431

C Supplementary Material: Mixed Effects Logistic Regression

C.1 Descriptive Statistics

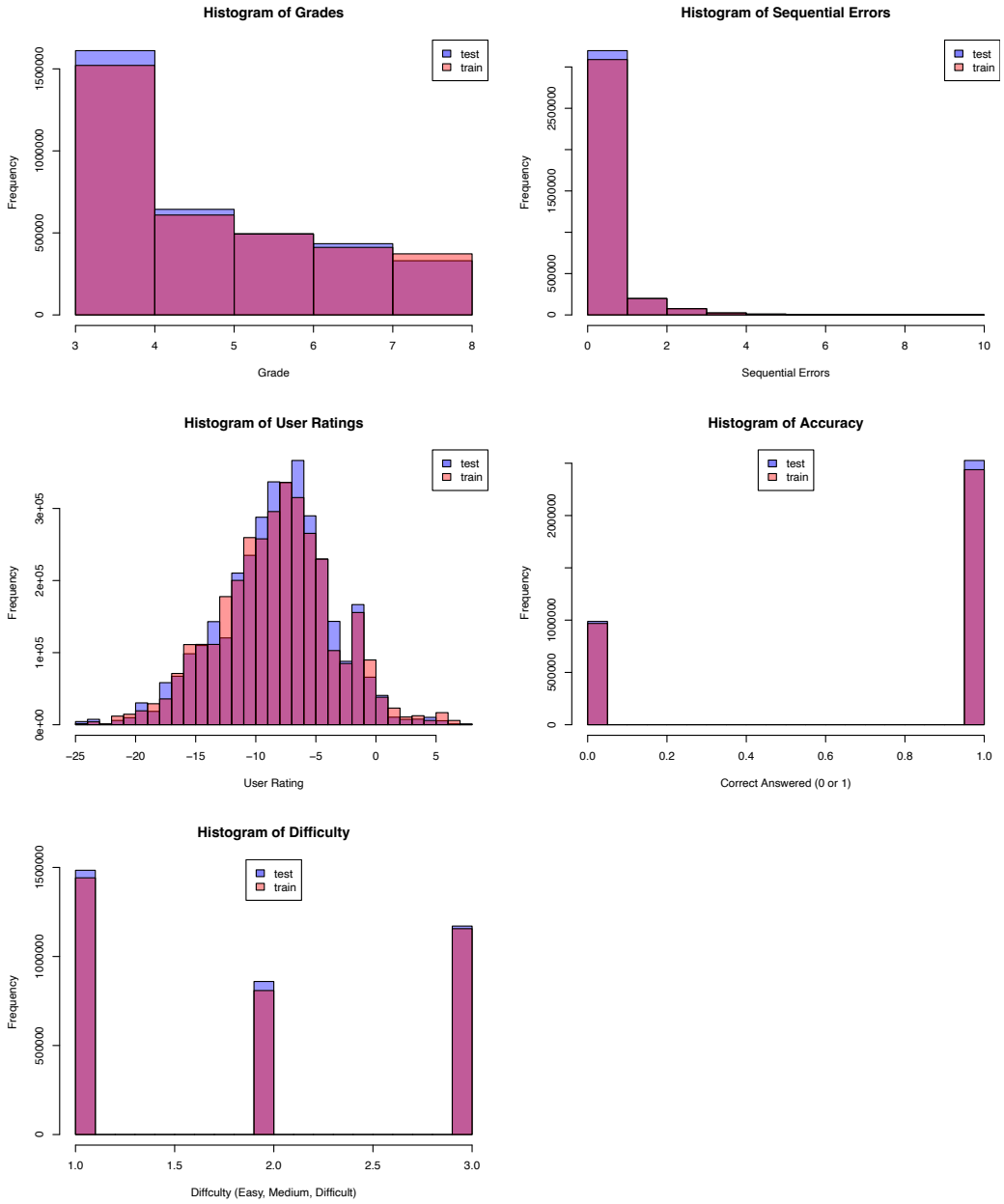

Figure C1: Distribution of key variables within the training and testing datasets.

C.2 GLMER Model Results

Table C1: Fixed Effect Model Coefficients

	Training Data				Testing Data			
	Estimate	SE	z value	p value	Estimate	SE	z value	p value
(Intercept)	-3.48	0.02	-152.11	<0.001	-3.57	0.02	-149.97	<0.001
Sequential Error	0.81	0.01	119.57	<0.001	0.81	0.01	125.46	<0.001
Rating	-0.10	0.01	-8.83	<0.001	-0.09	0.01	-8.09	<0.001
Grade	-0.05	0.00	-12.07	<0.001	-0.03	0.00	-7.30	<0.001

Note. SE = Standard Error.

Table C2: Variance Estimates of Random Effects

	Training Data		Testing Data	
	Estimate	Std. Deviation	Estimate	Std. Deviation
(Intercept)	0.39	0.62	0.41	0.64
Sequential Error	0.14	0.38	0.13	0.36

Table C3: Correlation Between Fixed Effects

	Training Data				Testing Data			
	1.	2.	3.	4.	1.	2.	3.	4.
1. (Intercept)	1.000	-0.073	0.281	-0.886	1.000	-0.095	0.263	-0.891
2. Sequential Errors	-0.073	1.000	0.007	-0.018	-0.095	1.000	-0.005	0.006
3. User Rating	0.281	0.007	1.000	-0.286	0.263	-0.005	1.000	-0.269
4. Grade	-0.886	-0.018	-0.286	1.000	-0.891	0.006	-0.269	1.000

Table C4: Correlation Between Random Effects

Dataset	Variance-Covariance	Std. Correlation	p value
Training	-0.02	-0.10	<0.001
Testing	-0.02	-0.10	<0.001