

Mixed Effects Regression

Test name: Mixed Effects Regression

Dataset: D:/DATA ANALYSIS/H Regression Tests and Models/Mixed Effects Regression/dataset.csv

Rows in original dataset: 649

Columns in original dataset: 33

Repeated grade columns used: G1, G2, G3

Long-format repeated rows used: 1947

Student clusters: 649

Formula: `grade_score ~ grade_period + studytime + failures + absences + age + Medu + Fedu + traveltime + school + sex + address`

Random effect: random intercept for student_id.

Estimation method: REML linear mixed effects model using nlme::lme.

Log likelihood: -3808.5268

AIC: 7645.0535

BIC: 7723.0036

ICC between-student: 0.8169

Pseudo R-squared from fitted values: 0.9073

Interpretation: fixed effects estimate average grade-score changes while accounting for repeated observations within students.

Decision guide: $p < 0.05$ and 95% CI not crossing 0 indicates stronger evidence for a fixed effect.

Mixed model guide: a larger ICC means student-level clustering explains a larger share of grade variation.

Charts generated: 9

Fixed effects

term	coefficient	standard_error	df	t_value	p_value	ci95_lower	ci95_upper
(Intercept)	9.457856367	1.45761801	1297	6.48856991	1.230004e-10	6.59830907	12.31740367
grade_period	0.253466872	0.03029019	1297	8.36795244	1.498647e-16	0.19404374	0.31289001
studytime	0.463908616	0.11951979	638	3.88143753	1.146448e-04	0.22920888	0.69860835
failures	-1.505054759	0.17224770	638	-8.73773498	2.089180e-17	-1.84329571	-1.16681381
absences	-0.067171527	0.02114441	638	-3.17679884	1.560963e-03	-0.10869257	-0.02565048
age	0.045158314	0.08263847	638	0.54645632	5.849434e-01	-0.11711796	0.20743459
Medu	0.274104782	0.11245858	638	2.43738443	1.506607e-02	0.05327109	0.49493848
Fedu	0.157905515	0.11285949	638	1.39913363	1.622589e-01	-0.06371546	0.37952649
travelttime	0.008574127	0.13844165	638	0.06193314	9.506355e-01	-0.26328226	0.28043051
schoolMS	-1.259512061	0.22338264	638	-5.63836133	2.580000e-08	-1.69816615	-0.82085797
sexM	-0.581070595	0.19923189	638	-2.91655419	3.663567e-03	-0.97230010	-0.18984109
addressU	0.284353388	0.22789632	638	1.24773139	2.125872e-01	-0.16316415	0.73187093

decision_alpha_0_05

Statistically significant

Statistically significant

Statistically significant

Statistically significant

Statistically significant

Not statistically significant

Statistically significant

Not statistically significant

Not statistically significant

Statistically significant

Statistically significant

Not statistically significant

Variance components

	component	variance	proportion_of_total_variance
	between_student_random_intercept_variance	5.313935	0.8169197
	within_student_residual_variance	1.190909	0.1830803
	total_variance	6.504844	1.0000000

Fit statistics

		model	estimation_method	n_long_rows	n_student_clusters		
Random-intercept mixed effects regression			REML	1947	649		
observations_per_cluster_mean	log_likelihood	aic	bic	residual_scale_variance	icc_between_student		
3	-3808.527	7645.054	7723.004	1.190909	0.8169197		
pseudo_r_squared_from_fitted_values							
0.9073113							
						formula	
grade_score ~ grade_period + studytime + failures + absences + age + Medu + Fedu + traveltime + school + sex + address							

















