

Cognitive load theory and its relationships with motivation: A self-determination theory perspective

Supplementary materials

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Table S1: Model parameter estimates

Measurement part	Est	SE	z	p	CI (lower)	CI (upper)	Std
Load Reduction Instruction							
lridif	1.000	.000			1.000	1.000	.785
lriscf	1.165	.040	29.119	.000	1.087	1.243	.897
lriprc	1.154	.044	26.092	.000	1.067	1.240	.908
lrifbk	1.162	.056	20.619	.000	1.051	1.272	.854
lriind	.849	.042	20.147	.000	.766	.931	.742
Extraneous Cognitive Load							
ExtCL1	1.000	.000			1.000	1.000	.860
ExtCL2	.988	.020	49.525	.000	.949	1.027	.886
ExtCL3	1.025	.027	37.624	.000	.972	1.079	.885
ExtCL4	.948	.028	34.237	.000	.894	1.003	.821
ExtCL5	.957	.031	30.459	.000	.895	1.019	.788
Intrinsic Cognitive Load							
IntCL2	1.000	.000			1.000	1.000	.715
IntCL3	1.371	.043	31.692	.000	1.286	1.456	.950
IntCL4	1.281	.043	30.045	.000	1.198	1.365	.934
IntCL5	1.141	.049	23.390	.000	1.045	1.237	.741
IntCL6	1.290	.045	28.543	.000	1.202	1.379	.847
Motivation							
rai1	1.000	.000			1.000	1.000	.911
rai2	.899	.020	44.111	.000	.859	.939	.909
rai3	.855	.018	48.610	.000	.820	.889	.897
rai4	1.063	.018	60.175	.000	1.029	1.098	.944
Engagement							
ageng	1.000	.000			1.000	1.000	.676
beeng	1.059	.043	24.675	.000	.975	1.143	.759
coeng	1.085	.043	25.294	.000	1.001	1.169	.702
emeng	1.458	.060	24.134	.000	1.340	1.577	.905
Disengagement							
NoCoop1	1.000	.000			1.000	1.000	.682
NoCoop3	1.110	.075	14.873	.000	.964	1.256	.678
NoCoop4	1.266	.061	20.895	.000	1.147	1.384	.777
NoCoop5	1.200	.061	19.674	.000	1.081	1.320	.669
NoCoop6	1.286	.072	17.771	.000	1.144	1.427	.781
School-reported Grade							
Grade_c	1.000	.000			1.000	1.000	1.000
Age							
age	1.000	.000			1.000	1.000	1.000
Gender							
Gender	1.000	.000			1.000	1.000	1.000
SES							
Hi_SES	1.000	.000			1.000	1.000	1.000

Structural Part	Est	SE	z	p	CI (lower)	CI (upper)	Std
Motivation							
Extraneous Cognitive Load	-.896	.439	-2.044	.041	-1.756	-.037	-.113
Intrinsic Cognitive Load	-2.285	.389	-5.876	.000	-3.047	-1.523	-.226
Load Reduction Instruction	4.386	.404	10.856	.000	3.595	5.178	.428
Age	-.231	.399	-.580	.562	-1.013	.551	-.021
Gender	.764	.682	1.121	.262	-.572	2.100	.030
SES	-.008	.016	-.535	.593	-.039	.022	-.013
Engagement							
Extraneous Cognitive Load	.020	.027	.747	.455	-.033	.073	.037
Intrinsic Cognitive Load	-.190	.026	-7.385	.000	-.240	-.140	-.275
Load Reduction Instruction	.426	.035	12.174	.000	.357	.495	.608
Age	-.028	.027	-1.017	.309	-.081	.026	-.038
Gender	-.024	.048	-.503	.615	-.119	.070	-.014
SES	.002	.001	1.494	.135	-.001	.004	.042

Disengagement

Extraneous Cognitive Load	.262	.049	5.371	.000	.167	.358	.383
Intrinsic Cognitive Load	-.014	.033	-.416	.677	-.080	.052	-.016
Load Reduction Instruction	-.108	.052	-2.076	.038	-.209	-.006	-.122
Age	-.003	.030	-.091	.928	-.061	.056	-.003
Gender	-.237	.071	-3.346	.001	-.375	-.098	-.109
SES	-.006	.002	-2.977	.003	-.009	-.002	-.104

Grade

Extraneous Cognitive Load	-.005	.027	-.168	.867	-.058	.049	-.012
Intrinsic Cognitive Load	-.120	.022	-5.496	.000	-.163	-.077	-.241
Load Reduction Instruction	.046	.032	1.426	.154	-.017	.109	.090
Age	-.014	.012	-1.164	.245	-.038	.010	-.027
Gender	.171	.049	3.460	.001	.074	.268	.137
SES	.001	.001	1.081	.280	-.001	.004	.042

Extraneous Cognitive Load

Load Reduction Instruction	-.883	.059	-14.922	.000	-.998	-.767	-.684
Age	-.050	.046	-1.101	.271	-.140	.039	-.037
Gender	-.074	.094	-.790	.429	-.258	.110	-.023
SES	.000	.002	.147	.883	-.003	.004	.004

Intrinsic Cognitive Load

Load Reduction Instruction	-.208	.047	-4.432	.000	-.300	-.116	-.205
Age	-.020	.049	-.400	.689	-.117	.077	-.019
Gender	.135	.092	1.474	.140	-.044	.314	.054
SES	-.001	.002	-.806	.420	-.005	.002	-.022

Load Reduction Instruction

Age	-.102	.051	-2.005	.045	-.201	-.002	-.097
Gender	-.092	.099	-.921	.357	-.286	.103	-.037
SES	.006	.002	2.798	.005	.002	.010	.098

Indirect Effects of LRI	Est	SE	z	p	CI (lower)	CI (upper)	Std
via Extraneous Load							
Motivation (indirect)	.791	.390	2.028	.043	.027	1.555	.077
Motivation (total)	5.177	.359	14.419	.000	4.474	5.881	.505
Engagement (indirect)	-.018	.023	-.758	.449	-.064	.028	-.025
Engagement (total)	.408	.029	13.981	.000	.351	.465	.582
Disengagement (indirect)	-.231	.045	-5.194	.000	-.319	-.144	-.262
Disengagement (total)	-.339	.040	-8.445	.000	-.418	-.260	-.383
Grade (indirect)	.004	.024	.168	.867	-.043	.051	.008
Grade (total)	.050	.017	2.886	.004	.016	.084	.098
via Intrinsic Load							
Motivation (indirect)	.039	.009	4.212	.000	.021	.058	.056
Motivation (total)	.465	.037	12.712	.000	.394	.537	.664
Engagement (indirect)	.474	.137	3.470	.001	.207	.742	.046
Engagement (total)	4.861	.439	11.079	.000	4.001	5.721	.474
Disengagement (indirect)	-.054	.014	-3.760	.000	-.083	-.026	-.078
Disengagement (total)	-.105	.054	-1.942	.052	-.210	.001	-.118
Grade (indirect)	.025	.008	3.169	.002	.010	.040	.049
Grade (total)	.071	.034	2.076	.038	.004	.137	.140

R-Square	Est.
Extraneous Cognitive Load	.463
Intrinsic Cognitive Load	.047
Motivation	.379
Engagement	.489
Disengagement	.246
Grade	.098

Table S2: Correlation estimates for teachers' motivating styles

Attuning	r	95%CI		p	Domineering	r	95%CI		p
Motivation	.479	.429	.536	.000	Motivation	-.258	-.315	-.186	.000
Engagement	.554	.512	.583	.000	Engagement	-.195	-.249	-.144	.000
Disengagement	-.257	-.321	-.194	.000	Disengagement	.373	.318	.424	.000
Extraneous	-.539	-.588	-.491	.000	Extraneous	.326	.265	.392	.000
Intrinsic	-.122	-.184	-.066	.000	Intrinsic	.186	.137	.244	.000
LRI	.741	.711	.775	.000	LRI	-.208	-.265	-.147	.000
Grade (school)	.162	.089	.239	.000	Grade (school)	-.182	-.246	-.109	.000
Grade (student)	.176	.114	.229	.000	Grade (student)	-.089	-.143	-.037	.002
Participative	r	95%CI		p	Demanding	r	95%CI		p
Motivation	.328	.282	.378	.000	Motivation	.049	-.012	.123	.135
Engagement	.394	.345	.438	.000	Engagement	.126	.073	.183	.000
Disengagement	-.102	-.171	-.030	.004	Disengagement	.040	-.016	.096	.179
Extraneous	-.372	-.426	-.312	.000	Extraneous	-.063	-.120	-.008	.049
Intrinsic	-.042	-.094	.007	.135	Intrinsic	.064	.016	.128	.017
LRI	.566	.531	.608	.000	LRI	.250	.189	.303	.000
Grade (school)	.025	-.062	.102	.532	Grade (school)	-.060	-.123	.006	.111
Grade (student)	.093	.037	.154	.003	Grade (student)	.058	.004	.108	.049
Awaiting	r	95%CI		p	Clarifying	r	95%CI		p
Motivation	-.161	-.216	-.103	.000	Motivation	.411	.364	.457	.000
Engagement	-.122	-.173	-.068	.000	Engagement	.487	.449	.529	.000
Disengagement	.296	.249	.344	.000	Disengagement	-.233	-.295	-.169	.000
Extraneous	.312	.260	.370	.000	Extraneous	-.484	-.541	-.434	.000
Intrinsic	.158	.111	.209	.000	Intrinsic	-.096	-.151	-.045	.002
LRI	-.224	-.296	-.155	.000	LRI	.684	.650	.723	.000
Grade (school)	-.042	-.102	.014	.170	Grade (school)	.104	.045	.163	.002
Grade (student)	-.087	-.148	-.030	.004	Grade (student)	.158	.102	.207	.000
Abandoning	r	95%CI		p	Guiding	r	95%CI		p
Motivation	-.321	-.375	-.263	.000	Motivation	.478	.428	.528	.000
Engagement	-.285	-.331	-.235	.000	Engagement	.554	.515	.589	.000
Disengagement	.443	.389	.489	.000	Disengagement	-.305	-.364	-.242	.000
Extraneous	.450	.398	.495	.000	Extraneous	-.546	-.599	-.497	.000
Intrinsic	.188	.136	.246	.000	Intrinsic	-.135	-.195	-.075	.000
LRI	-.379	-.429	-.316	.000	LRI	.756	.728	.786	.000
Grade (school)	-.131	-.196	-.058	.001	Grade (school)	.181	.119	.245	.000
Grade (student)	-.109	-.173	-.062	.000	Grade (student)	.197	.129	.251	.000