Supplementary Materials

Table S1. *Sample Flow and Wave Participation.*

	n
Initially recruited	1,072
Excluded for data at fewer than two waves	48
Analytic sample	1,024
Participated in all three waves	788
Participated in exactly two waves	236
W1–W2 only	164
W2–W3 only	43
W1–W3 only	29
Participated in W1	981
Participated in W2	995
Participated in W3	860

Note. Wave-specific sample sizes refer to the availability of focal longitudinal construct data used to classify participation and may therefore differ from the item-specific valid sample sizes reported in Supplementary Table S6. Participation was nonmonotonic because students who missed one classroom assessment could contribute data at a later wave. The three mutually exclusive two-wave patterns (W1–W2 only, W2–W3 only, and W1–W3 only) sum to 236 participants. Included participants contributed focal data at two or more waves, whereas excluded participants contributed focal data at fewer than two waves. PN = psychological need satisfaction; IGD = Internet gaming disorder; PMPU = problematic mobile-phone use; SNSA = social networking-site addiction; W1–W3 = Waves 1–3.

Table S2. *Inclusion Analysis: Included vs. Excluded Participants.*

Characteristic	Included *n*	Included *M* (*SD*) or *n* (%)	Excluded *n*	Excluded *M* (*SD*) or *n* (%)	Test	*p*	Effect size [95% CI]
Age	1,013	14.35 (2.00)	25	14.44 (2.06)	$t(25.1) = -0.21$	.835	$g = -0.044$ [−.441, .353]
Gender	1,021	541 (53.0% female)	27	16 (59.3% female)	Fisher's exact test	.563	$RD = -.063$ [−.251, .125]
School stage	1,024	409 (39.9% high school)	48	24 (50.0% high school)	Fisher's exact test	.177	$RD = -.101$ [−.245, .044]
PN at W1	981	4.77 (1.15)	9	3.74 (0.79)	$t(8.3) = 3.90$	.004	$g = 0.898$ [.241, 1.556]
IGD at W1	980	1.66 (0.72)	9	1.74 (0.71)	$t(8.2) = -0.32$	.758	$g = -0.105$ [−.761, .552]
PMPU at W1	982	2.81 (1.22)	9	2.67 (0.73)	$t(8.4) = 0.58$	.580	$g = 0.116$ [−.540, .773]
SNSA at W1	982	1.87 (0.86)	9	1.48 (0.53)	$t(8.4) = 2.20$	.058	$g = 0.459$ [−.198, 1.115]

Note. Included participants contributed focal data at two or more waves, whereas excluded participants contributed focal data at fewer than two waves. Baseline focal scores were available for only nine excluded participants; those comparisons should therefore be interpreted cautiously. Continuous variables were compared using Welch's t tests and Hedges g, whereas categorical variables were compared using Fisher's exact tests and risk differences (RD). PN = psychological need satisfaction; IGD = Internet gaming disorder; PMPU = problematic mobile-phone use; SNSA = social networking-site addiction.

Table S3. *Wave–Specific Mobile–Phone Ownership and Digital–Use Distributions.*

Variable and category	W1	W2	W3
Own mobile phone	Valid *n* = 983; missing *n* = 41	Valid *n* = 1,011; missing *n* = 13	Valid *n* = 860; missing *n* = 164
Yes	743 (75.6%)	774 (76.6%)	650 (75.6%)
No	240 (24.4%)	237 (23.4%)	210 (24.4%)
Weekly phone time	Valid *n* = 981; missing *n* = 43	Valid *n* = 1,009; missing *n* = 15	Valid *n* = 860; missing *n* = 164
1 hour or less	202 (20.6%)	153 (15.2%)	137 (15.9%)
1–3 hours	223 (22.7%)	223 (22.1%)	187 (21.7%)
3–5 hours	193 (19.7%)	215 (21.3%)	208 (24.2%)
5–7 hours	155 (15.8%)	180 (17.8%)	147 (17.1%)
7–14 hours	92 (9.4%)	102 (10.1%)	90 (10.5%)
14+ hours	116 (11.8%)	136 (13.5%)	91 (10.6%)
Weekly game time	Valid *n* = 979; missing *n* = 45	Valid *n* = 1,006; missing *n* = 18	Valid *n* = 860; missing *n* = 164
1 hour or less	557 (56.9%)	503 (50.0%)	473 (55.0%)
1–3 hours	220 (22.5%)	241 (24.0%)	188 (21.9%)
3–5 hours	87 (8.9%)	118 (11.7%)	93 (10.8%)
5–7 hours	52 (5.3%)	54 (5.4%)	38 (4.4%)
7–14 hours	18 (1.8%)	40 (4.0%)	21 (2.4%)
14+ hours	45 (4.6%)	50 (5.0%)	47 (5.5%)
Weekly social–media time	Valid *n* = 981; missing *n* = 43	Valid n = 1,009; missing *n* = 15	Valid *n* = 859; missing *n* = 165
1 hour or less	431 (43.9%)	441 (43.7%)	340 (39.6%)
1–3 hours	283 (28.8%)	277 (27.5%)	273 (31.8%)
3–5 hours	134 (13.7%)	140 (13.9%)	124 (14.4%)
5–7 hours	63 (6.4%)	73 (7.2%)	60 (7.0%)
7–14 hours	29 (3.0%)	36 (3.6%)	29 (3.4%)
14+ hours	41 (4.2%)	42 (4.2%)	33 (3.8%)

Note. Valid and missing sample sizes are reported separately for each variable and wave. Percentages are based on valid responses within each wave and variable. W1–W3 = Waves 1–3.

Table S4. *Baseline Gender Comparisons for the Main Study Variables.*

Construct	Male *n*	*M* (*SD*)	Female *n*	*M* (*SD*)	Welch *t* (*df*)	*p*	Hedges *g*	95% CI
PN	461	4.814 (1.196)	517	4.731 (1.095)	−1.125 (937.4)	.261	−0.072	[−.198, .053]
IGD	461	1.835 (0.780)	516	1.517 (0.635)	−6.927 (888.1)	< .001	−0.449	[−.576, −.322]
PMPU	462	2.771 (1.246)	517	2.841 (1.200)	0.896 (955.6)	.371	0.057	[−.068, .183]
SNSA	461	1.772 (0.888)	518	1.966 (0.821)	3.530 (941.3)	< .001	0.227	[.101, .353]

Note. Gender comparisons were coded as female minus male; positive Hedges g values therefore indicate higher scores among girls. Welch's t tests were used for gender comparisons. Three participants with missing gender were excluded from gender comparisons. These analyses were descriptive and were not used to define subgroups or alter the longitudinal model specifications. PN = psychological need satisfaction; IGD = Internet gaming disorder; PMPU = problematic mobile-phone use; SNSA = social networking-site addiction.

Table S5. *Baseline Age Comparisons for the Main Study Variables.*

Construct	*n*	*r*	*p*	95% CI
PN	970	.006	.852	[−.057, .069]
IGD	969	.053	.101	[−.010, .115]
PMPU	971	.283	< .001	[.224, .340]
SNSA	971	.263	< .001	[.204, .321]

Note. Age associations are Pearson correlations with baseline age. PN = psychological need satisfaction; IGD = Internet gaming disorder; PMPU = problematic mobile-phone use; SNSA = social networking-site addiction.

Table S6. *Reliability, Variance Decomposition, and Longitudinal Measurement Invariance: Wave-Specific Reliability.*

Construct	W1 *n*	W1 α	W1 ω	W2 *n*	W2 α	W2 ω	W3 *n*	W3 α	W3 ω
PN	981	.907	.940	992	.939	.961	854	.932	.953
AUT	981	.852	.854	993	.896	.897	853	.884	.886
COM	979	.891	.900	992	.908	.912	853	.896	.901
REL	981	.851	.858	991	.911	.913	852	.880	.883
IGD	980	.899	.904	997	.926	.928	857	.927	.930
PMPU	982	.895	.895	996	.901	.902	857	.891	.891
SNSA	982	.899	.902	997	.926	.928	858	.914	.915

Note. For PN, ω represents omega total for the multidimensional global composite derived from the correlated autonomy, competence, and relatedness factors. PN = psychological need satisfaction; AUT = autonomy; COM = competence; REL = relatedness; IGD = Internet gaming disorder; PMPU = problematic mobile-phone use; SNSA = social networking-site addiction.

Table S7. *Reliability, Variance Decomposition, and Longitudinal Measurement Invariance: Variance Decomposition.*

Construct	Between−person variance	Within−person variance	ICC	Within−person *SD*
PN	.410	.976	.296	.988
AUT	.452	1.311	.256	1.145
COM	.495	1.296	.276	1.138
REL	.497	1.338	.271	1.157
IGD	.212	.365	.367	.604
PMPU	.616	.784	.440	.885
SNSA	.251	.493	.338	.702

Note. ICC = intraclass correlation coefficient; PN = psychological need satisfaction; AUT = autonomy; COM = competence; REL = relatedness; IGD = Internet gaming disorder; PMPU = problematic mobile-phone use; SNSA = social networking-site addiction.

Table S8. *Reliability, Variance Decomposition, and Longitudinal Measurement Invariance: Longitudinal Measurement Invariance of the Joint Multiple-Indicator Measurement Models.*

Model pair	Invariance level	χ^2	*df*	CFI	TLI	RMSEA [90% CI]	SRMR	Comparison	ΔCFI	ΔRMSEA
PN–IGD	Configural	1290.253	543	.945	.936	.037 [.034, .039]	.035	—	—	—
	Metric	1322.824	563	.944	.937	.036 [.034, .039]	.038	vs. Configural	.001	.001
	Scalar	1409.690	583	.939	.934	.037 [.035, .040]	.038	vs. Metric	.005	.001
PN–PMPU	Configural	608.146	282	.971	.964	.034 [.030, .037]	.027	—	—	—
	Metric	623.101	296	.971	.965	.033 [.029, .036]	.028	vs. Configural	.000	.001
	Scalar	659.815	310	.969	.965	.033 [.030, .037]	.029	vs. Metric	.002	.000
PN–SNSA	Configural	765.102	282	.959	.950	.041 [.037, .044]	.029	—	—	—
	Metric	790.398	296	.959	.951	.040 [.037, .044]	.032	vs. Configural	.000	.001
	Scalar	850.877	310	.955	.949	.041 [.038, .045]	.032	vs. Metric	.004	.001

Note. PN = psychological need satisfaction; AUT = autonomy; COM = competence; REL = relatedness; IGD = Internet gaming disorder; PMPU = problematic mobile-phone use; SNSA = social networking-site addiction.

Table S9. *Fit, Measurement−Constraint Check, and Structural Estimates for the Multiple−Indicator Latent RI−CLPMs: Preferred Scalar−CU Integrated Models.*

Outcome	χ^2 (*df*)	CFI	TLI	RMSEA [90% CI]	SRMR	Normal termination	Admissible
IGD	1416.133 (584)	.939	.934	.037 [.035, .040]	.040	Yes	Yes
PMPU	666.944 (311)	.968	.964	.033 [.030, .037]	.032	Yes	Yes
SNSA	857.190 (311)	.954	.948	.041 [.038, .045]	.034	Yes	Yes

Note. PN was indicated by the autonomy, competence, and relatedness dimension scores; each digital−use outcome was indicated by its original items. Corresponding indicator residuals were correlated across waves (CU). Metric−CU and scalar−CU refer to measurement constraints; autoregressive and cross−lagged paths were freely estimated across the two intervals.

Table S10. *Fit, Measurement−Constraint Check, and Structural Estimates for the Multiple−Indicator Latent RI−CLPMs: Metric-CU Versus Scalar-CU Structural Estimate Check.*

Outcome	Metric−CU RI *r*	Scalar−CU RI *r*	ΔCFI	ΔRMSEA	Max |Δβ|	Conclusion
IGD	−.447	−.442	−.005	.001	.002	Interpretation unchanged
PMPU	−.619	−.614	−.002	.000	.001	Interpretation unchanged
SNSA	−.436	−.431	−.004	.000	.001	Interpretation unchanged

Note. PN was indicated by the autonomy, competence, and relatedness dimension scores; each digital−use outcome was indicated by its original items. Corresponding indicator residuals were correlated across waves (CU). Metric−CU and scalar−CU refer to measurement constraints; autoregressive and cross−lagged paths were freely estimated across the two intervals.

Table S11. *Fit, Measurement−Constraint Check, and Structural Estimates for the Multiple−Indicator Latent RI−CLPMs: Random−Intercept Correlations.*

Outcome	Parameter	*r*	Robust *SE*	*p*	95% CI
IGD	Random−intercept correlation	−.442	.174	.011	[−.783, −.102]
PMPU	Random−intercept correlation	−.614	.172	< .001	[−.952, −.277]
SNSA	Random−intercept correlation	−.431	.253	.088	[−.926, .064]

Note. PN was indicated by the autonomy, competence, and relatedness dimension scores; each digital−use outcome was indicated by its original items. Corresponding indicator residuals were correlated across waves (CU). Metric−CU and scalar−CU refer to measurement constraints; autoregressive and cross−lagged paths were freely estimated across the two intervals.

Table S12. *Fit, Measurement−Constraint Check, and Structural Estimates for the Multiple−Indicator Latent RI−CLPMs: Autoregressive Paths.*

Outcome	Parameter	β	Robust *SE*	*p*	95% CI
IGD	PN autoregression W1−W2	.263	.079	.001	[.109, .417]
IGD	PN autoregression W2−W3	.201	.078	.010	[.049, .353]
IGD	Outcome autoregression W1−W2	.143	.079	.070	[−.012, .299]
IGD	Outcome autoregression W2−W3	.140	.073	.057	[−.004, .283]
PMPU	PN autoregression W1−W2	.231	.079	.004	[.076, .387]
PMPU	PN autoregression W2−W3	.182	.076	.017	[.033, .332]
PMPU	Outcome autoregression W1−W2	.297	.074	< .001	[.152, .442]
PMPU	Outcome autoregression W2−W3	.126	.102	.213	[−.073, .325]
SNSA	PN autoregression W1−W2	.257	.077	.001	[.105, .409]
SNSA	PN autoregression W2−W3	.202	.077	.009	[.051, .353]
SNSA	Outcome autoregression W1−W2	.346	.070	< .001	[.210, .483]
SNSA	Outcome autoregression W2−W3	.162	.093	.081	[−.020, .345]

Note. PN was indicated by the autonomy, competence, and relatedness dimension scores; each digital−use outcome was indicated by its original items. Corresponding indicator residuals were correlated across waves (CU). Metric−CU and scalar−CU refer to measurement constraints; autoregressive and cross−lagged paths were freely estimated across the two intervals.

Table S13. *Fit, Measurement−Constraint Check, and Structural Estimates for the Multiple−Indicator Latent RI−CLPMs: Cross−Lagged Paths.*

Outcome	Parameter	β	Robust *SE*	*p*	95% CI
IGD	PN → outcome W1−W2	−.059	.068	.383	[−.192, .074]
IGD	PN → outcome W2−W3	.038	.064	.549	[−.087, .164]
IGD	Outcome → PN W1−W2	−.008	.062	.899	[−.130, .114]
IGD	Outcome → PN W2−W3	−.005	.058	.937	[−.119, .109]
PMPU	PN → outcome W1−W2	−.055	.064	.391	[−.181, .071]
PMPU	PN → outcome W2−W3	.046	.076	.550	[−.104, .195]
PMPU	Outcome → PN W1−W2	−.042	.063	.509	[−.166, .082]
PMPU	Outcome → PN W2−W3	.063	.072	.380	[−.078, .204]
SNSA	PN → outcome W1−W2	−.051	.060	.393	[−.169, .066]
SNSA	PN → outcome W2−W3	.014	.062	.822	[−.108, .136]
SNSA	Outcome → PN W1−W2	−.010	.058	.862	[−.125, .104]
SNSA	Outcome → PN W2−W3	.082	.065	.210	[−.046, .209]

Note. PN was indicated by the autonomy, competence, and relatedness dimension scores; each digital−use outcome was indicated by its original items. Corresponding indicator residuals were correlated across waves (CU). Metric−CU and scalar−CU refer to measurement constraints; autoregressive and cross−lagged paths were freely estimated across the two intervals.

Table S14. *Dimension−Specific Secondary Composite−Score RI−CLPMs: Selected Models and Random−Intercept Correlations.*

Need	Outcome	Model	χ^2 (*df*)	CFI	TLI	RMSEA [90% CI]	SRMR	RI *r*	*p*	95% CI	BH *p*
AUT	IGD	M4	3.598 (5)	1.000	1.000	.000 [.000, .037]	.014	−.181	.203	[−.460, .098]	.231
AUT	PMPU	M4	12.549 (5)	.985	.954	.038 [.012, .066]	.028	−.317	.033	[−.609, −.025]	.059
AUT	SNSA	M3	4.853 (3)	.995	.974	.025 [.000, .063]	.015	−.101	.616	[−.496, .294]	.616
COM	IGD	M4	14.105 (5)	.978	.935	.042 [.017, .069]	.031	−.527	.008	[−.917, −.136]	.018
COM	PMPU	M1	6.793 (1)	.989	.842	.075 [.030, .133]	.019	−.636	< .001	[−.972, −.300]	< .001
COM	SNSA	M3	13.458 (3)	.974	.869	.058 [.029, .092]	.024	−.519	.049	[−1.035 , −.003]	.073
REL	IGD	M4	9.164 (5)	.989	.968	.029 [.000, .057]	.025	−.403	.001	[−.649, −.157]	.004
REL	PMPU	M3	8.823 (3)	.989	.943	.044 [.011, .078]	.022	−.415	.002	[−.676, −.154]	.006
REL	SNSA	M3	6.576 (3)	.990	.950	.034 [.000, .070]	.018	−.236	.205	[−.602, .129]	.231

Note. The nine RI-CLPMs were estimated separately; autonomy, competence, and relatedness were not entered simultaneously and therefore the estimates do not represent mutually adjusted or unique effects. M1 = unconstrained model; M3 = cross-lagged paths constrained equal across intervals; M4 = autoregressive and cross-lagged paths constrained equal across intervals. Benjamini–Hochberg adjustment was applied separately to the nine random-intercept correlations and the 36 cross-lagged paths. BH-adjusted p values are shown for the random-intercept correlations. None of the 36 cross-lagged paths was statistically significant before adjustment. Because several selected models had very low degrees of freedom, TLI and RMSEA should be interpreted cautiously. TLI values greater than 1.00 were displayed as 1.00; the unrounded Mplus value for the AUT–IGD model was 1.011. AUT = autonomy; COM = competence; REL = relatedness; IGD = Internet gaming disorder; PMPU = problematic mobile-phone use; SNSA = social networking-site addiction; W1–W3 = Waves 1–3.

Table S15. *Dimension–Specific Secondary Composite–Score RI–CLPMs: Cross-Lagged Paths.*

Need	Outcome	Model	Parameter	β	Robust *SE*	*p*	95% CI
AUT	IGD	M4	Need → outcome W1–W2	−.025	.047	.587	[−.117, .066]
AUT	IGD	M4	Need → outcome W2–W3	−.024	.044	.586	[−.111, .063]
AUT	IGD	M4	Outcome → need W1–W2	−.063	.043	.145	[−.147, .022]
AUT	IGD	M4	Outcome → need W2–W3	−.070	.048	.146	[−.164, .024]
AUT	PMPU	M4	Need → outcome W1–W2	−.046	.045	.307	[−.133, .042]
AUT	PMPU	M4	Need → outcome W2–W3	−.046	.045	.303	[−.133, .042]
AUT	PMPU	M4	Outcome → need W1–W2	−.064	.049	.196	[−.160, .033]
AUT	PMPU	M4	Outcome → need W2–W3	−.062	.048	.196	[−.155, .032]
AUT	SNSA	M3	Need → outcome W1–W2	−.033	.044	.461	[−.120, .054]
AUT	SNSA	M3	Need → outcome W2–W3	−.032	.044	.458	[−.118, .053]
AUT	SNSA	M3	Outcome → need W1–W2	−.039	.048	.417	[−.133, .055]
AUT	SNSA	M3	Outcome → need W2–W3	−.039	.048	.415	[−.134, .055]
COM	IGD	M4	Need → outcome W1–W2	.012	.049	.807	[−.084, .108]
COM	IGD	M4	Need → outcome W2–W3	.011	.046	.808	[−.079, .101]
COM	IGD	M4	Outcome → need W1–W2	−.007	.039	.855	[−.084, .069]
COM	IGD	M4	Outcome → need W2–W3	−.008	.042	.855	[−.091, .075]
COM	PMPU	M1	Need → outcome W1–W2	−.034	.050	.503	[−.132, .065]
COM	PMPU	M1	Need → outcome W2–W3	.081	.065	.213	[−.046, .208]
COM	PMPU	M1	Outcome → need W1–W2	−.037	.055	.505	[−.145, .072]
COM	PMPU	M1	Outcome → need W2–W3	.056	.060	.354	[−.062, .174]
COM	SNSA	M3	Need → outcome W1–W2	−.002	.046	.967	[−.092, .088]
COM	SNSA	M3	Need → outcome W2–W3	−.002	.045	.967	[−.090, .086]
COM	SNSA	M3	Outcome → need W1–W2	.021	.047	.647	[−.070, .113]
COM	SNSA	M3	Outcome → need W2–W3	.022	.048	.647	[−.072, .116]
REL	IGD	M4	Need → outcome W1–W2	.001	.045	.988	[−.088, .089]
REL	IGD	M4	Need → outcome W2–W3	.001	.045	.988	[−.087, .088]
REL	IGD	M4	Outcome → need W1–W2	.033	.041	.427	[−.048, .113]
REL	IGD	M4	Outcome → need W2–W3	.037	.046	.425	[−.054, .127]
REL	PMPU	M3	Need → outcome W1–W2	−.051	.043	.239	[−.136, .034]
REL	PMPU	M3	Need → outcome W2–W3	−.056	.047	.233	[−.148, .036]
REL	PMPU	M3	Outcome → need W1–W2	−.006	.047	.894	[−.099, .086]
REL	PMPU	M3	Outcome → need W2–W3	−.006	.047	.894	[−.098, .085]
REL	SNSA	M3	Need → outcome W1–W2	−.053	.042	.210	[−.136, .030]
REL	SNSA	M3	Need → outcome W2–W3	−.055	.043	.206	[−.139, .030]
REL	SNSA	M3	Outcome → need W1–W2	.036	.048	.447	[−.057, .130]
REL	SNSA	M3	Outcome → need W2–W3	.038	.051	.449	[−.061, .138]

Note. The nine RI-CLPMs were estimated separately; autonomy, competence, and relatedness were not entered simultaneously and therefore the estimates do not represent mutually adjusted or unique effects. M1 = unconstrained model; M3 = cross-lagged paths constrained equal across intervals; M4 = autoregressive and cross-lagged paths constrained equal across intervals. Benjamini–Hochberg adjustment was applied separately to the nine random-intercept correlations and the 36 cross-lagged paths. BH-adjusted p values are shown for the random-intercept correlations. None of the 36 cross-lagged paths was statistically significant before adjustment. Because several selected models had very low degrees of freedom, TLI and RMSEA should be interpreted cautiously. TLI values greater than 1.00 were displayed as 1.00; the unrounded Mplus value for the AUT–IGD model was 1.011. AUT = autonomy; COM = competence; REL = relatedness; IGD = Internet gaming disorder; PMPU = problematic mobile-phone use; SNSA = social networking-site addiction; W1–W3 = Waves 1–3.

Table S16. *Composite−Score RI−CLPM Robustness Analyses: M1−M4 Model Fit.*

Outcome	Model	Selected	χ^2 (*df*)	CFI	TLI	RMSEA [90% CI]	SRMR	AIC	BIC
IGD	M1	No	10.686 (1)	.977	.651	.097 [.051, .154]	.019	14845.8	14974.0
IGD	M2	No	7.406 (3)	.989	.947	.038 [.000, .073]	.023	14843.2	14961.6
IGD	M3	No	10.510 (3)	.982	.910	.049 [.019, .083]	.022	14844.1	14962.5
IGD	M4	Yes	9.555 (5)	.989	.967	.030 [.000, .058]	.026	14841.4	14949.9
PMPU	M1	No	7.793 (1)	.987	.809	.081 [.036, .139]	.019	17197.0	17325.2
PMPU	M2	No	12.446 (3)	.982	.912	.055 [.026, .089]	.027	17201.0	17319.4
PMPU	M3	Yes	12.417 (3)	.982	.912	.055 [.026, .089]	.026	17198.8	17317.1
PMPU	M4	No	17.820 (5)	.976	.928	.050 [.026, .076]	.036	17203.2	17311.6
SNSA	M1	No	8.853 (1)	.980	.698	.088 [.042, .144]	.017	15632.5	15760.7
SNSA	M2	No	13.701 (3)	.973	.863	.059 [.030, .092]	.030	15640.1	15758.5
SNSA	M3	Yes	10.868 (3)	.980	.899	.051 [.021, .085]	.021	15632.5	15750.9
SNSA	M4	No	17.586 (5)	.968	.903	.050 [.026, .076]	.035	15640.4	15748.9

Note. M1 = unconstrained; M2 = autoregressive paths constrained equal across intervals; M3 = cross−lagged paths constrained equal; M4 = autoregressive and cross−lagged paths constrained equal. Model comparisons used MLR−scaled likelihood−ratio tests. Equality constraints were imposed on unstandardized coefficients.

Table S17. *Composite−Score RI−CLPM Robustness Analyses: MLR−Scaled Likelihood−Ratio Comparisons.*

Outcome	Comparison	Scaled $\Delta\chi^2$	Δdf	*p*	Selected model
IGD	M2 vs. M1	0.899	2	.638	M4
IGD	M3 vs. M1	2.089	2	.352	M4
IGD	M4 vs. M1	2.665	4	.615	M4
IGD	M4 vs. M2	1.924	2	.382	M4
IGD	M4 vs. M3	0.797	2	.671	M4
PMPU	M2 vs. M1	5.699	2	.058	M3
PMPU	M3 vs. M1	5.058	2	.080	M3
PMPU	M4 vs. M3	5.817	2	.055	M3
SNSA	M2 vs. M1	7.126	2	.028	M3
SNSA	M3 vs. M1	3.633	2	.163	M3
SNSA	M4 vs. M3	6.857	2	.032	M3

Note. M1 = unconstrained; M2 = autoregressive paths constrained equal across intervals; M3 = cross−lagged paths constrained equal; M4 = autoregressive and cross−lagged paths constrained equal. Model comparisons used MLR−scaled likelihood−ratio tests. Equality constraints were imposed on unstandardized coefficients.

Table S18. *Composite−Score RI−CLPM Robustness Analyses: Selected−Model Focal Estimates.*

Outcome	Model	Parameter	Standardized estimate	Robust *SE*	*p*	95% CI
IGD	M4	Random−intercept correlation	−.428	.141	.002	[−.704, −.151]
IGD	M4	PN → outcome W1−W2	.002	.046	.962	[−.088, .093]
IGD	M4	PN → outcome W2−W3	.002	.047	.962	[−.090, .094]
IGD	M4	Outcome → PN W1−W2	−.003	.041	.944	[−.082, .077]
IGD	M4	Outcome → PN W2−W3	−.003	.045	.944	[−.091, .085]
PMPU	M3	Random−intercept correlation	−.533	.145	< .001	[−.818, −.249]
PMPU	M3	PN → outcome W1−W2	−.021	.046	.644	[−.111, .068]
PMPU	M3	PN → outcome W2−W3	−.024	.052	.642	[−.125, .077]
PMPU	M3	Outcome → PN W1−W2	−.018	.047	.698	[−.111, .074]
PMPU	M3	Outcome → PN W2−W3	−.018	.046	.698	[−.107, .072]
SNSA	M3	Random−intercept correlation	−.346	.210	.099	[−.757, .065]
SNSA	M3	PN → outcome W1−W2	−.026	.044	.554	[−.112, .060]
SNSA	M3	PN → outcome W2−W3	−.027	.046	.551	[−.118, .063]
SNSA	M3	Outcome → PN W1−W2	.019	.046	.682	[−.071, .108]
SNSA	M3	Outcome → PN W2−W3	.019	.047	.683	[−.073, .112]

Note. M1 = unconstrained; M2 = autoregressive paths constrained equal across intervals; M3 = cross−lagged paths constrained equal; M4 = autoregressive and cross−lagged paths constrained equal. Model comparisons used MLR−scaled likelihood−ratio tests. Equality constraints were imposed on unstandardized coefficients.

Table S19. *Covariate-Adjusted, Classroom-Clustering, and Severity-Restricted Sensitivity Analyses: Covariate-Adjusted Primary Latent RI-CLPMs.*

Outcome	Unadjusted *r* [95% CI]	Adjusted residual *r*	Robust *SE*	*p*	95% CI	Max |Δβ|
IGD	−.442 [−.783, −.102]	−.489	.182	.007	[−.845, −.132]	.009
PMPU	−.614 [−.952, −.277]	−.725	.210	.001	[−1.137, −.314]	.016
SNSA	−.431 [−.926, .064]	−.575	.323	.075	[−1.208, .057]	.015

Note. Covariates included gender, baseline age, and baseline subjective family socioeconomic status. Baseline subjective family socioeconomic status was assessed using a 1–10 ladder.

Table S20. *Covariate-Adjusted, Classroom-Clustering, and Severity-Restricted Sensitivity Analyses: Standard and Classroom-Cluster-Robust Estimates.*

Outcome	Model	Parameter	Standard β	Standard *SE*	Cluster-robust *SE*	Cluster-robust *p*	Cluster-robust 95% CI
IGD	M4	Random-intercept correlation	−.428	.141	.171	.012	[−.763, −.092]
IGD	M4	PN → outcome W1−W2	.002	.046	.042	.958	[−.081, .085]
IGD	M4	PN → outcome W2−W3	.002	.047	.043	.958	[−.082, .087]
IGD	M4	Outcome → PN W1−W2	−.003	.041	.038	.941	[−.077, .072]
IGD	M4	Outcome → PN W2−W3	−.003	.045	.042	.941	[−.086, .079]
PMPU	M3	Random−intercept correlation	−.533	.145	.156	.001	[−.839, −.228]
PMPU	M3	PN → outcome W1−W2	−.021	.046	.045	.640	[−.110, .067]
PMPU	M3	PN → outcome W2−W3	−.024	.052	.051	.637	[−.123, .075]
PMPU	M3	Outcome → PN W1−W2	−.018	.047	.041	.659	[−.099, .063]
PMPU	M3	Outcome → PN W2−W3	−.018	.046	.040	.661	[−.097, .062]
SNSA	M3	Random−intercept correlation	−.346	.210	.212	.102	[−.761, .069]
SNSA	M3	PN → outcome W1−W2	−.026	.044	.042	.536	[−.108, .056]
SNSA	M3	PN → outcome W2−W3	−.027	.046	.044	.532	[−.113, .059]
SNSA	M3	Outcome → PN W1−W2	.019	.046	.044	.668	[−.067, .104]
SNSA	M3	Outcome → PN W2−W3	.019	.047	.045	.668	[−.069, .108]

Note. Classroom-clustering analyses used the same selected model structures (IGD M4, PMPU M3, and SNSA M3). Point estimates were unchanged, and standard errors were adjusted for clustering within 25 classrooms.

Table S21. *Covariate-Adjusted, Classroom-Clustering, and Severity-Restricted Sensitivity Analyses: Severity−Restricted Composite−Score RI−CLPMs.*

Outcome	Rule	Cutoff	*n*	χ^2 (*df*)	CFI	TLI	RMSEA [90% CI]	SRMR	Status
IGD	Scale-midpoint-based cutoff	3	61	7.140 (5)	.791	.374	.084 [.000, .210]	.073	Inadmissible: negative random-intercept variance
IGD	Upper quartile (ties retained)	2	293	3.848 (5)	1.000	1.080	.000 [.000, .071]	.027	Inadmissible solution
PMPU	Scale-midpoint-based cutoff	4	189	11.870 (3)	.710	−.449	.125 [.056, .203]	.049	Poor fit
PMPU	Upper quartile (ties retained)	3.67	266	10.850 (3)	.746	−.268	.099 [.040, .166]	.041	Inadmissible solution
SNSA	Scale-midpoint-based cutoff	3	124	7.421 (3)	.454	−1.730	.109 [.000, .211]	.058	Inadmissible: negative random-intercept variance
SNSA	Upper quartile (ties retained)	2.33	302	9.836 (3)	.804	.019	.087 [.030, .150]	.035	Inadmissible solution

Note. Scale-midpoint-based baseline cutoffs were mean scores ≥ 3 for IGD, ≥ 4 for PMPU, and ≥ 3 for SNSA. These cutoffs represented the scale midpoint on the 1–5 measures and the first integer response above the midpoint on the 1–6 PMPU measure; they were exploratory severity cutoffs, not diagnostic thresholds. Distribution-based analyses used baseline upper-quartile cutoffs with ties retained. Improper or poorly fitting models were not interpreted.