

Supplementary Material

Generative AI Literacy and Multidimensional AI Anxiety among Chinese Arts University Students: Mixed-Methods Evidence of Differentiated Adaptation

Yong Xin, Junjie Gavin Wu, and Wei Wei

The supplementary tables below document the scale-adaptation audits, questionnaire block map, raw major labels, prior-use-adjusted sensitivity analyses, measurement-model evidence, matched-panel selection-risk audit, D4-D5 chronology/context audit, construct-content overlap diagnostics, and mixed-methods integration rubric. Retrospective documentary classifications are explicitly distinguished from contemporaneous pre-study records.

Supplementary Table S1A. Retrospective source-to-adapted item map for the 16-item GenAI literacy instrument

Source item	Source-item meaning (paraphrased)	Implemented item	Implemented content (English summary)	Classification	Audit rationale
CL1	Effective collaboration with GAI during digital multimodal composing (DMC)	CL1	Understanding GenAI applications in music production/education	Substantially modified	Source emphasizes collaboration ability; implemented item emphasizes disciplinary understanding.
CL2	Meaningful use of GAI in DMC to achieve goals	CL2	Applying GenAI in music production and teaching practice	Contextualized	Core use/application target retained with disciplinary substitution.
CL3	Knowledge of prompt engineering in GAI-assisted DMC	-	-	Omitted	No focal literacy item directly assesses prompt engineering.
CL4	Evaluation and selection of appropriate GAI responses/solutions	CL4	Evaluating advantages and limitations of GenAI in music production/education	Substantially modified	Both concern evaluation, but the evaluation target changes materially.
-	-	CL3	Analyzing functions and roles of GenAI in music production/education	Newly added	No sufficiently close source item.
BL1	Active participation in GAI-related DMC learning activities	BL1	Active participation in GenAI-related music production/education practice	Contextualized	Active-participation target retained with disciplinary substitution.
BL2	Engagement with GAI-literacy materials to improve comprehensibility of DMC work	BL2	Frequent use of GenAI tools for music production/micro-lesson production	Substantially modified	Implemented item assesses practical tool-use frequency rather than learning-material engagement.
BL3	Willingness to invest time/effort learning GAI to improve multimodal cohesion	BL3	Willingness to learn AI to improve music-production/teaching capability	Contextualized	Time/effort investment retained; objective contextualized.
BL4	Using GAI-assisted DMC to improve language-learning performance beyond class	BL4	Planned continued GenAI use in future music production/teaching	Substantially modified	Current learning-performance use shifts to future continued-use intention.
BL5	Keeping up to date with latest GAI technologies for DMC	-	-	Omitted	No focal item directly assesses staying updated with new technologies.
AL1	Personalized DMC experience enabled by GAI	AL1	Personalized music-learning experience	Contextualized	Personalization retained with disciplinary substitution.
AL2	Playful/engaging human-AI interaction during DMC	-	-	Omitted	No focal AL item directly assesses playful/engaging interaction.
AL3	Autonomy/choice supported by GAI during DMC	-	-	Omitted	No focal AL item directly assesses autonomy/choice.
AL4	Ease in getting GAI to perform the desired task	AL4	Perceived ease of using GenAI to complete music production	Contextualized	Core ease target retained with task substitution.
AL5	Anthropomorphic similarity between GAI	-	-	Omitted from focal literacy	Conceptually related anthropomorphism

Source item	Source-item meaning (paraphrased)	Implemented item	Implemented content (English summary)	Classification	Audit rationale
	expression and human expression				items were administered elsewhere in the 59-item questionnaire.
-	-	AL2	Perceived creativity enhancement in music production/education	Newly added	No sufficiently close source item.
-	-	AL3	Positive expectations for GenAI use in music production/education	Newly added	No sufficiently close source item.
EL1	Awareness of discrimination/exclusion risk	EL1	Attention to bias and discrimination in music production/education	Contextualized	Ethical-risk target retained and contextualized.
EL2	Awareness of misuse risk	EL2	Awareness of misuse, copyright infringement, and content misuse	Contextualized	Misuse retained with discipline-specific examples.
EL3	Awareness of misinformation/disinformation risk	EL3	Attention to false information in music production/education	Contextualized	Misinformation target retained and contextualized.
-	-	EL4	Ethical implications for human musical creativity and professional expertise	Newly added	No sufficiently close source EL item.

Note. Source-item meanings are paraphrased from the final 17-item GAIDMCS reported by Liu et al. (2025); no copyrighted source item is reproduced verbatim. Contextualized indicates preservation of the central conceptual target with professional-context substitution. Substantially modified indicates an identifiable source basis but a material change in the target. Omitted indicates no focal counterpart. Newly added indicates no sufficiently close source counterpart. No item was classified as verbatim retained because the administered items were rewritten for the disciplinary context. These classifications are a retrospective documentary audit, not a contemporaneous adaptation log.

Supplementary Table S1B. Retrospective source-to-administered item correspondence for the 21-item AI Anxiety instrument

Source item	Source-item content (paraphrased)	Administered item	Administered Chinese wording	Retrospective correspondence note
LA1	Learning special AI functions evokes anxiety.	LA1	学习理解人工智能技术或产品的各种特殊功能会让我感到焦虑。	Close semantic correspondence; source used 7 categories, administered questionnaire used 6. Translation/adaptation procedure was not contemporaneously documented.
LA2	Learning to use AI evokes anxiety.	LA2	学习使用人工智能技术或产品会让我感到焦虑。	Close semantic correspondence; source used 7 categories, administered questionnaire used 6. Translation/adaptation procedure was not contemporaneously documented.
LA3	Learning specific AI functions evokes anxiety.	LA3	学习使用人工智能技术或产品的具体功能会让我感到焦虑。	Close semantic correspondence; source used 7 categories, administered questionnaire used 6. Translation/adaptation procedure was not contemporaneously documented.
LA4	Learning how AI works evokes anxiety.	LA4	学习人工智能技术或产品的工作原理会让我感到焦虑。	Close semantic correspondence; source used 7 categories, administered questionnaire used 6. Translation/adaptation procedure was not contemporaneously documented.
LA5	Learning to interact with AI evokes anxiety.	LA5	学习如何与人工智能技术或产品进行交互会让我感到焦虑。	Close semantic correspondence; source used 7 categories, administered questionnaire used 6. Translation/adaptation procedure was not contemporaneously documented.
LA6	Taking a course on AI development evokes anxiety.	LA6	参加关于人工智能技术或产品开发课程会让我感到焦虑。	Close semantic correspondence; source used 7 categories, administered questionnaire used 6. Translation/adaptation procedure was not contemporaneously documented.

LA7	Reading an AI manual evokes anxiety.	LA7	阅读人工智能技术或产品的说明手册会让我感到焦虑。	Close semantic correspondence; source used 7 categories, administered questionnaire used 6. Translation/adaptation procedure was not contemporaneously documented.
LA8	Being unable to keep pace with AI advances evokes anxiety.	LA8	无法跟上人工智能技术或产品的发展会让我感到焦虑。	Close semantic correspondence; source used 7 categories, administered questionnaire used 6. Translation/adaptation procedure was not contemporaneously documented.
JR1	Concern that AI may create human dependence.	JR1	我担心人工智能技术或产品可能会使人类产生依赖。	Close semantic correspondence; source used 7 categories, administered questionnaire used 6. Translation/adaptation procedure was not contemporaneously documented.
JR2	Concern that AI may make people lazier.	JR2	我担心人工智能技术或产品可能会使人类变得更加懒惰。	Close semantic correspondence; source used 7 categories, administered questionnaire used 6. Translation/adaptation procedure was not contemporaneously documented.
JR3	Concern that AI may replace humans.	JR3	我担心人工智能技术或产品可能会取代人类。	Close semantic correspondence; source used 7 categories, administered questionnaire used 6. Translation/adaptation procedure was not contemporaneously documented.
JR4	Concern that widespread humanoid robots may take jobs.	JR4	我担心类机器人的广泛使用可能会取代人类的工作。	Close semantic correspondence; source used 7 categories, administered questionnaire used 6. Translation/adaptation procedure was not contemporaneously documented.
JR5	Concern that using AI may create dependence and reduce reasoning.	JR5	我担心如果开始使用人工智能技术或产品，我可能会产生依赖并失去部分推理能力。	Close semantic correspondence; source used 7 categories, administered questionnaire used 6. Translation/adaptation procedure was not contemporaneously documented.
JR6	Concern that AI may replace someone's job.	JR6	我担心人工智能技术或产品可能会取代某些人的工作。	Close semantic correspondence; source used 7 categories, administered questionnaire used 6. Translation/adaptation procedure was not contemporaneously documented.
ST1	Concern that AI may be misused.	ST1	我担心人工智能技术或产品可能会被误用。	Close semantic correspondence; source used 7 categories, administered questionnaire used 6. Translation/adaptation procedure was not contemporaneously documented.
ST2	Concern about potential problems associated with AI.	ST2	我担心人工智能技术或产品可能带来的各种潜在问题。	Close semantic correspondence; source used 7 categories, administered questionnaire used 6. Translation/adaptation procedure was not contemporaneously documented.
ST3	Concern that AI may lose control or malfunction.	ST3	我担心人工智能技术或产品可能会失控并发生故障。	Close semantic correspondence; source used 7 categories, administered questionnaire used 6. Translation/adaptation procedure was not contemporaneously documented.
ST4	Concern that AI may lead to robot autonomy.	ST4	我担心人工智能技术或产品可能会导致机器人具备自主性。	Close semantic correspondence; source used 7 categories, administered questionnaire used 6. Translation/adaptation procedure was not contemporaneously documented.
AC1	Fear of humanoid AI/robots.	AC1	我觉得类人人工智能技术或产品（如类机器人）很可怕。	Close semantic correspondence; source used 7 categories, administered questionnaire used 6. Translation/adaptation procedure was not contemporaneously documented.
AC2	Intimidation by humanoid AI/robots.	AC2	我觉得类人人工智能技术或产品（如类机器人）令人感到害怕。	Close semantic correspondence; source used 7 categories, administered questionnaire used 6. Translation/adaptation procedure was not contemporaneously documented.

AC3	Unspecified fear response to humanoid AI/robots.	AC3	我不知道为什么，但类人工智能技术或产品（如类机器人）会让我感到害怕。	Close semantic correspondence; source used 7 categories, administered questionnaire used 6. Translation/adaptation procedure was not contemporaneously documented.
-----	--	-----	------------------------------------	--

Note. Source-item content is paraphrased from Wang and Wang (2022) rather than reproduced verbatim. The administered Chinese wording is reproduced from the original study questionnaire. This is a retrospective semantic audit only; it does not establish a documented translation/back-translation process or validated equivalence. The source AIAS used seven response categories, whereas the administered questionnaire used six categories (1 = 完全不符合 to 6 = 完全符合).

Supplementary Table S1C. Complete 59-item questionnaire block map

Block	Items	Role in broader questionnaire	Used in focal substantive analyses	Used in whole-battery straightline screen
Cognitive Literacy (CL)	4	Focal literacy	Yes	Yes
Behavioral Literacy (BL)	4	Focal literacy	Yes	Yes
Affective Literacy (AL)	4	Focal literacy	Yes	Yes
Ethical Literacy (EL)	4	Focal literacy	Yes	Yes
Anthropomorphic interaction	5	Nonfocal block	No	Yes
AI comfort	6	Nonfocal block	No	Yes
Technical skills	4	Nonfocal block	No	Yes
Helpfulness	7	Nonfocal block	No	Yes
Learning Anxiety (LA)	8	Focal anxiety	Yes	Yes
Job-Replacement Anxiety (JR)	6	Focal anxiety	Yes	Yes
Sociotechnical Blindness Anxiety (ST)	4	Focal anxiety	Yes	Yes
AI Configuration Anxiety (AC)	3	Focal anxiety	Yes	Yes
TOTAL	59	37 focal + 22 nonfocal	37 items	59 items

Note. The focal substantive analyses used 16 literacy plus 21 anxiety items (37 total). All 59 structured items were used only for the exact whole-battery straightlining screen.

Supplementary Table S2. Raw free-text major labels in the primary quality-screened and full eligible D1 samples

Original raw response	Working English gloss	Primary n	Primary %	Full n	Full %
音乐学	Musicology	117	33.0%	163	35.4%
音乐教育	Music Education	126	35.5%	155	33.7%
音乐表演	Music Performance	44	12.4%	53	11.5%
舞蹈表演	Dance Performance	22	6.2%	30	6.5%
音教	Abbreviated raw label	8	2.3%	11	2.4%
音乐	Music	5	1.4%	7	1.5%

Original raw response	Working English gloss	Primary n	Primary %	Full n	Full %
音乐教育专业	Music Education major	7	2.0%	7	1.5%
舞表	Abbreviated raw label	4	1.1%	5	1.1%
音乐学（师范）	Musicology (teacher education)	1	0.3%	4	0.9%
声乐歌剧	Vocal Music/Opera	3	0.8%	3	0.7%
美声	Bel canto	2	0.6%	3	0.7%
音舞	Abbreviated raw label	2	0.6%	3	0.7%
音乐舞蹈学院	School/College of Music and Dance	2	0.6%	3	0.7%
舞蹈表演专业	Dance Performance major	2	0.6%	2	0.4%
音表	Abbreviated raw label	2	0.6%	2	0.4%
管乐与乐队训练	Wind Music and Ensemble Training	2	0.6%	2	0.4%
声乐歌剧学院美声	Bel canto / Vocal Music and Opera school	1	0.3%	1	0.2%
舞蹈	Dance	1	0.3%	1	0.2%
管教	Abbreviated raw label	1	0.3%	1	0.2%
lxq.2005	No discipline gloss assigned	0	0.0%	1	0.2%
钢琴表演	Piano Performance	1	0.3%	1	0.2%
器乐	Instrumental Music	1	0.3%	1	0.2%
声乐表演	Vocal Performance	1	0.3%	1	0.2%
Total		355	100%	460	100%

Note. Raw labels are preserved exactly. English glosses are descriptive working translations, not official program names. No broad post hoc recoding was imposed because several labels are abbreviated, ambiguous, or department-level.

Supplementary Table S3. Prespecified literacy-anxiety associations after adjustment for prior video- and music-related GenAI use

Sample	Association	B	SE	beta	95% CI	Raw p	Holm p	Sensitivity pattern
Primary n=355	CL-LA	-0.106	.070	-.114	[-.243, .032]	.1318	.3955	Not supported
Primary n=355	BL-LA	.045	.097	.047	[-.145, .235]	.6425	1.000	Not supported
Primary n=355	AL-LA	.148	.088	.153	[-.024, .320]	.0922	.3689	Not supported
Primary n=355	AL-AC	-.003	.058	-.003	[-.118, .111]	.9557	1.000	Not supported
Primary n=355	EL-JR	.224	.057	.239	[.113, .336]	<.0001	.0004	Remains positive
Primary n=355	EL-ST	.289	.056	.311	[.179, .398]	<.0001	<.0001	Remains positive

Sample	Association	B	SE	beta	95% CI	Raw p	Holm p	Sensitivity pattern
Full n=460	CL-LA	-.053	.068	-.054	[-.186, .080]	.4341	.8682	Not supported
Full n=460	BL-LA	.075	.099	.075	[-.119, .270]	.4489	.8682	Not supported
Full n=460	AL-LA	.237	.090	.230	[.061, .414]	.0085	.0340	Sensitivity-only support
Full n=460	AL-AC	.151	.059	.136	[.036, .265]	.0101	.0340	Sensitivity-only support
Full n=460	EL-JR	.337	.049	.347	[.241, .433]	<.0001	<.0001	Remains positive
Full n=460	EL-ST	.391	.048	.409	[.297, .484]	<.0001	<.0001	Remains positive

Note. Both prior-use variables were entered categorically in every equation of the same restricted FGLS/SUR system, with no prior use as the reference and separate indicators for occasional, frequent, and very frequent use. Participant-identifier-cluster-robust uncertainty estimates were retained. The same six focal coefficients were Holm adjusted within each sample. These are sensitivity analyses and do not eliminate residual confounding.

Supplementary Table S4. Detailed measurement-model evidence

Panel A. CFA model fit.

Model	Sample	chi-square	df	CFI	TLI	RMSEA [95% CI]	SRMR
Literacy 4-factor	Primary n=355	395.90	98	.949	.937	.093 [.081, .104]	.045
Literacy 4-factor	Full n=460	563.25	98	.950	.939	.102 [.092, .111]	.040
Literacy CL+BL merged 3-factor	Primary n=355	651.05	101	.905	.887	.124 [.113, .135]	.059
Literacy CL+BL merged 3-factor	Full n=460	886.24	101	.916	.901	.130 [.121, .140]	.050
AI Anxiety 4-factor	Primary n=355	790.80	183	.937	.928	.097 [.089, .105]	.052
AI Anxiety 4-factor	Full n=460	1067.89	183	.944	.936	.103 [.096, .110]	.045

Panel B. Primary-sample convergent measurement evidence.

Measure	Factor	Sample	CR	AVE	Standardized loading range
Literacy	CL	Primary n=355	.924	.752	.815-.933
Literacy	BL	Primary n=355	.909	.715	.807-.866
Literacy	AL	Primary n=355	.946	.814	.770-.950
Literacy	EL	Primary n=355	.937	.790	.775-.940
AI Anxiety	LA	Primary n=355	.977	.841	.822-.944
AI Anxiety	JR	Primary n=355	.940	.724	.714-.902
AI Anxiety	ST	Primary n=355	.939	.795	.785-.932
AI Anxiety	AC	Primary n=355	.971	.919	.945-.969

Panel C. Selected discriminant-validity diagnostics.

Measure	Pair	Primary latent r	Primary HTMT	Full latent r	Full HTMT
---------	------	------------------	--------------	---------------	-----------

Measure	Pair	Primary latent r	Primary HTMT	Full latent r	Full HTMT
Literacy	CL-BL	.825	.843	.878	.891
Literacy	BL-AL	.786	.793	.844	.851
AI Anxiety	JR-ST	.772	.780	.850	.856
AI Anxiety	LA-AC	.575	.578	.722	.724

Note. The complete pairwise HTMT/factor-correlation matrix is available in the analysis archive. Six-category items were treated as approximately continuous; no ordinal WLSMV model was estimated.

Supplementary Table S5. D4 matched-versus-D4-only selection/matching-risk audit

Panel A. Baseline dimension comparisons.

Dimension	Matched n=47 M (SD)	D4-only n=53 M (SD)	SMD d	Welch raw p	Holm p
CL	3.463 (0.872)	3.189 (1.018)	.288	.150	1.000
BL	3.473 (0.917)	3.354 (0.999)	.124	.534	1.000
AL	3.840 (0.899)	3.778 (0.746)	.076	.710	1.000
EL	4.064 (0.930)	4.009 (0.800)	.063	.756	1.000
LA	3.229 (0.879)	3.396 (0.779)	-.202	.318	1.000
JR	3.894 (0.809)	3.877 (0.849)	.020	.922	1.000
ST	4.122 (0.783)	4.193 (0.824)	-.088	.660	1.000
AC	3.340 (1.273)	3.547 (1.180)	-.169	.404	1.000

Note. No baseline dimension comparison met the Holm-adjusted criterion; nonsignificance does not establish equivalence.

Panel B. Observed categorical characteristics and response-quality composition.

Characteristic	Categories	Matched n=47	D4-only n=53	Exact/Fisher p	Cramer V
Gender	Male / Female	12.8% / 87.2%	11.3% / 88.7%	1.000	.022
Year	Year 1 / Year 2	17.0% / 83.0%	11.3% / 88.7%	.565	.082
Prior video-AI use	None / occasional / frequent / very frequent	4.3 / 78.7 / 14.9 / 2.1%	7.5 / 67.9 / 20.8 / 3.8%	.696	.124
Prior music-AI use	None / occasional / frequent	53.2 / 46.8 / 0.0%	62.3 / 34.0 / 3.8%	.228	.178
Exact 59-item straightlining at D4	Yes / No	10.6% / 89.4%	0.0% / 100%	.020	.244

Note. The first four characteristic tests were also Holm adjusted as a four-test family; none met the adjusted criterion. Straightlining was reported as a separate response-quality diagnostic.

Repeating dimension comparisons after excluding the five matched D4 straightliners yielded no Holm-adjusted baseline difference.

Supplementary Table S6. D4-D5 chronology, context, and evidentiary-status audit

Component	Researcher documentation	Directly observed file/questionnaire evidence	Revised evidentiary status
D4 calendar date	Researcher record: March 1, 2026	Platform submissions: May 19-June 12, 2026	Unresolved discrepancy; March 1 not treated as verified administration date
D5 calendar date	Researcher record: June 30, 2026	Platform submissions: June 16-26, 2026	Unresolved discrepancy; June 30 not treated as verified administration date
Within-pair ordering	D4 designated earlier/pre; D5 later/post	Every matched D4 timestamp preceded corresponding D5 timestamp	Supported as ordered waves
Instructional sequence	Four approximately 30-min sessions between designated waves	No survey-export field verifies session dates	Activity content documented; exact dates unverified
Participant identity	Same two-class participants reported	47 exact one-to-one ID matches; no duplicate/ambiguous pairs	Verified identity matching
Common measures	Same questionnaire family reported	59 common items in same relative order; 4 D5-only items excluded	Item equivalence supported for repeated comparison
Literacy context	Research documentation describes Broadcasting/Hosting activities	Literacy items explicitly reference music production/music learning/education	Context mismatch; literacy changes exploratory and not activity-specific
AI Anxiety context	General AI-related anxiety	Items refer broadly to AI technologies/products	Less directly affected by disciplinary mismatch
Qualitative linkage	Independent reflections/interviews	No verified linkage to D1 or D4-D5 panel	Integration limited to construct/theme/context level
Causal interpretation	Activities occurred around ordered measurements	Single group; no randomized control; selection and chronology limits	No intervention-effect claim

Note. Where researcher documentation and platform metadata conflict, neither source is selectively declared correct without independent corroboration. Identity matching and within-pair ordering are stronger than exact calendar chronology. The literacy context mismatch is treated as a measurement/interpretation limitation rather than repaired through post hoc item selection.

Supplementary Table S7. Ethical Literacy-Sociotechnical Blindness/Job-Replacement construct-content overlap diagnostics (primary n = 355)

Panel A. Construct-content adjacency audit.

Item	Administered content summary	Nearest adjacent content in the comparison construct	Interpretive note
EL1	Bias/discrimination in music-production/education uses	No direct ST equivalent	Fairness/discrimination focus is distinct from ST operational-risk items.
EL2	Misuse risk, including copyright and teaching-content misuse	ST1 misuse; ST2 potential problems	Clearest semantic adjacency; shared misuse/risk-awareness content is plausible.
EL3	Misinformation risk in music-production/education	ST2 potential problems	Related broad risk awareness, but information integrity is not directly measured by ST.
EL4	Ethical implications for human creativity and professional expertise	ST2 potential problems	Broad consequence awareness; professional/human-agency emphasis is distinct.
ST1	AI misuse	EL2 misuse risk	Direct adjacency with EL2.
ST2	Potential problems associated with AI	EL2-EL4 broad risk/consequence content	Broad wording can covary with multiple EL risk-awareness items.
ST3	Loss of control/malfunction	No direct EL equivalent	System-control/reliability concern is distinct from EL item wording.

ST4	Robot autonomy	No direct EL equivalent	Autonomy concern is distinct from the administered EL items.
-----	----------------	-------------------------	--

Panel B. EL-by-ST item-level Pearson correlations.

	ST1	ST2	ST3	ST4
EL1	0.302	0.296	0.245	0.194
EL2	0.386	0.402	0.343	0.223
EL3	0.371	0.340	0.331	0.225
EL4	0.347	0.333	0.310	0.247

Summary: EL-ST cross-item $r = .194-.402$ (mean = .306); within-EL item $r = .678-.863$; within-ST item $r = .699-.877$; observed scale-mean $r = .363$; HTMT = .389. Pearson correlations are reported consistently with the approximate-continuous treatment used in the main analysis.

Panel C. EL-by-JR item-level Pearson correlations.

	JR1	JR2	JR3	JR4	JR5	JR6
EL1	0.268	0.206	0.052	0.120	0.189	0.144
EL2	0.374	0.307	0.115	0.238	0.300	0.294
EL3	0.327	0.303	0.080	0.224	0.275	0.252
EL4	0.339	0.297	0.101	0.235	0.261	0.253

Summary: EL-JR cross-item $r = .052-.374$ (mean = .231); observed scale-mean $r = .285$; HTMT = .308.

Panel D. Reviewer-requested two-factor exploratory loading diagnostic for EL and ST items.

Item	Intended factor	Absolute intended loading	Absolute cross-loading
EL1	EL	.760	.145
EL2	EL	.883	.219
EL3	EL	.907	.185
EL4	EL	.923	.166
ST1	ST	.915	.216
ST2	ST	.899	.207
ST3	ST	.900	.172
ST4	ST	.772	.099

Note. Maximum-likelihood two-factor exploratory factor analysis with varimax rotation, conducted only as a reviewer-requested diagnostic. Factor signs are arbitrary; absolute loadings are shown. The diagnostic does not replace the prespecified measurement models and cannot rule out semantic overlap.

Supplementary Table S8. Mixed-methods integration definitions and contextual-support rubric

Panel A. Integration categories.

Category	Definition in this study	Participant-linkage implication
CONVERGENCE	Independent quantitative and qualitative strands are consistent with the same bounded construct-level or study-context interpretation.	Does not imply within-person co-occurrence unless explicit identifiers link the strands; no such D1/D4-D5 linkage was available here.
COMPLEMENTARITY	Qualitative material extends, illustrates, or contextualizes a quantitative finding without independently confirming the relation.	Contextual/theme-level only under the present linkage structure.
DIVERGENCE	Strands differ in direction, scope, or construct meaning.	Not interpreted as contradiction within the same people when samples are unlinked.
SILENCE	Qualitative material is insufficient or not construct-aligned enough to assess the quantitative finding.	No participant-level inference is permitted.

Panel B. Contextual-support strength.

Label	Criteria	Use in this study	Important boundary
Strong participant-level support	Requires robust quantitative evidence plus directly linked qualitative evidence from the same participants and close construct alignment.	Not assigned.	Unavailable because D9/D11/Q1 were not verified as linked to D1 or D4-D5.
Moderate contextual support	Quantitative finding is robust or stable; qualitative themes are closely construct-aligned and recur across more than one source, with deviant cases considered.	Used only as contextual/construct-level support.	Does not upgrade the finding to participant-level mixed-methods evidence.
Tentative contextual support	Indirect or sparse qualitative alignment, heterogeneous/deviant cases, construct mismatch, or weaker quantitative stability.	Used for EL-JR and several secondary patterns.	Interpretation remains illustrative rather than independent validation of the quantitative relation.
Low/insufficient support	Little direction- or construct-equivalent qualitative evidence.	Mapped to SILENCE or noncore interpretation.	No attempt is made to rescue a quantitative finding.

Note. Integration category and contextual-support strength are separate qualitative judgments; no numerical integration score was calculated. Criteria considered quantitative robustness, construct alignment, breadth across qualitative sources, negative/deviant cases, and linkage level.

References cited in Supplementary Tables S1A-S1B

Liu, M., Zhang, L. J., & Zhang, D. (2025). Enhancing student GAI literacy in digital multimodal composing through development and validation of a scale. *Computers in Human Behavior*, 166, 108569. <https://doi.org/10.1016/j.chb.2025.108569>

Wang, Y.-Y., & Wang, Y.-S. (2022). Development and validation of an artificial intelligence anxiety scale: An initial application in predicting motivated learning behavior. *Interactive Learning Environments*, 30(4), 619-634. <https://doi.org/10.1080/10494820.2019.1674887>