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SUPPLEMENTARY MATERIALS

From Intelligent Tutoring Systems to Generative AI: Changing Educational Priorities in Research Involving Asian-Affiliated Scholars

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These materials provide the complete search syntax, geographic operationalisation, analysis settings, extended Biblioshiny outputs, TALL diagnostics, and reproducibility notes supporting the article. They should be read with the main text. Relational metrics describe conceptual structure rather than educational quality or effectiveness, and the abstract-level analysis elaborates rather than validates the bibliometric maps.

Supplementary Note S1. Geographic and temporal operationalisation

Affiliation-defined scope. A record qualified when the Scopus query returned at least one affiliation in one of the 32 AFFILCOUNTRY values reproduced in Table S2, Panel A. This criterion identifies scholarship involving the selected affiliations; it does not establish the study setting, participants' location, or collective representativeness of Asian education systems.

Corresponding-author coverage. The Biblioshiny corresponding-author output contained authors from 65 countries in total. Under the regional classification applied in the article, 34 of these were Asian countries or territories (Table S2, Panel B). This count exceeds the number of locations represented among corresponding authors from the original filter set because internationally co-authored records may have a corresponding author in a location not used as an eligibility filter.

Temporal coverage. The exported publication-year field contained records from 2010 through 2026. Coverage for 2026 is partial through 23 May 2026. Although the Scopus display string ended with ‘PUBYEAR < 2025’, the exported metadata contained 2025 and 2026 records; year eligibility was therefore verified from the exported PY field. The string in Table S1 is retained verbatim to document the interface output rather than silently rewriting it.

Supplementary Note S2. Data linkage and reproducibility

The deposited data are available under CC BY 4.0 in Mendeley Data, Version 2. Dataset 1 contains the Scopus bibliographic metadata used for the Biblioshiny analyses, and Dataset 2 contains the abstract corpus prepared for TALL. For exact reproduction, the deposited files should be used rather than a fresh Scopus export, because indexing, citation counts, and affiliation metadata may change over time. The realised TALL sample is preserved in Dataset 2; drawing a new 50% sample may produce different frequency and topic estimates.

Table S1. ***Complete Scopus search string displayed at retrieval***

Verbatim Scopus syntax
TITLE-ABS-KEY ("artificial intelligence" OR AI OR "machine learning" OR "deep learning" OR "natural language processing" OR "intelligent tutoring system*" OR "learning analytics" OR "educational data mining" OR chatbot* OR "generative AI" OR ChatGPT OR "large language model*") AND TITLE-ABS-KEY (education OR educational OR learning OR teaching OR student* OR teacher* OR classroom* OR school* OR universit* OR "higher education" OR "online learning" OR "e-learning") AND (LIMIT-TO (SUBJAREA , "SOCI") OR LIMIT-TO (SUBJAREA , "PSYC")) AND (LIMIT-TO (DOCTYPE , "ar")) AND (LIMIT-TO (SRCTYPE , "j")) AND (LIMIT-TO (LANGUAGE , "English")) AND (LIMIT-TO (EXACTKEYWORD , "Education") OR LIMIT-TO (EXACTKEYWORD , "Educational Technology") OR LIMIT-TO (EXACTKEYWORD , "Higher Education") OR LIMIT-TO (EXACTKEYWORD , "Students") OR EXCLUDE (EXACTKEYWORD , "Education Computing") OR EXCLUDE (EXACTKEYWORD , "Humans") OR EXCLUDE (EXACTKEYWORD , "Engineering Education") OR EXCLUDE (EXACTKEYWORD , "Machine Learning") OR EXCLUDE (EXACTKEYWORD , "Learning Analytics") OR EXCLUDE (EXACTKEYWORD , "Female") OR EXCLUDE (EXACTKEYWORD , "Male") OR EXCLUDE (EXACTKEYWORD , "Medical Education") OR EXCLUDE (EXACTKEYWORD , "Adult") OR EXCLUDE (EXACTKEYWORD , "Data Mining") OR EXCLUDE (EXACTKEYWORD , "Adversarial Machine Learning") OR EXCLUDE (EXACTKEYWORD , "Decision Making") OR EXCLUDE (EXACTKEYWORD , "Clinical Competence") OR EXCLUDE (EXACTKEYWORD , "Medical Student") OR EXCLUDE (EXACTKEYWORD , "Educational Data Mining") OR EXCLUDE (EXACTKEYWORD , "Learning Analytic") OR EXCLUDE (EXACTKEYWORD , "Human Experiment") OR EXCLUDE (EXACTKEYWORD , "Students, Medical") OR EXCLUDE (EXACTKEYWORD , "Young Adult") OR EXCLUDE (EXACTKEYWORD , "Controlled Study") OR EXCLUDE (EXACTKEYWORD , "Personnel Training") OR EXCLUDE (EXACTKEYWORD , "Learning Algorithms") OR EXCLUDE (EXACTKEYWORD , "Natural Language Processing Systems") OR EXCLUDE (EXACTKEYWORD , "Education, Medical, Undergraduate") OR EXCLUDE (EXACTKEYWORD , "Nursing Education") OR EXCLUDE (EXACTKEYWORD , "Nursing Student") OR EXCLUDE (EXACTKEYWORD , "Students, Nursing") OR EXCLUDE (EXACTKEYWORD , "Information Management") OR EXCLUDE (EXACTKEYWORD , "Education, Medical") OR EXCLUDE (EXACTKEYWORD , "Big Data") OR EXCLUDE (EXACTKEYWORD , "Predictive Analytics") OR EXCLUDE (EXACTKEYWORD , "Major Clinical Study") OR EXCLUDE (EXACTKEYWORD , "Automation") OR EXCLUDE (EXACTKEYWORD , "Education, Nursing, Baccalaureate") OR EXCLUDE (EXACTKEYWORD , "Randomized Controlled Trial") OR EXCLUDE (EXACTKEYWORD , "Job Analysis") OR EXCLUDE (EXACTKEYWORD , "Intelligent Tutoring")) AND (LIMIT-TO (AFFILCOUNTRY , "China") OR LIMIT-TO (AFFILCOUNTRY , "Saudi Arabia") OR LIMIT-TO (AFFILCOUNTRY , "Malaysia") OR LIMIT-TO (AFFILCOUNTRY , "Indonesia") OR LIMIT-TO (AFFILCOUNTRY , "India") OR LIMIT-TO (AFFILCOUNTRY , "Hong Kong") OR LIMIT-TO (AFFILCOUNTRY , "Turkey") OR LIMIT-TO (AFFILCOUNTRY , "Taiwan") OR LIMIT-TO (AFFILCOUNTRY , "United Arab Emirates") OR LIMIT-TO (AFFILCOUNTRY , "South Korea") OR LIMIT-TO (AFFILCOUNTRY , "Thailand") OR LIMIT-TO (AFFILCOUNTRY , "Singapore") OR LIMIT-TO (AFFILCOUNTRY , "Viet Nam") OR LIMIT-TO (AFFILCOUNTRY , "Philippines") OR LIMIT-TO (AFFILCOUNTRY , "Oman") OR LIMIT-TO (AFFILCOUNTRY , "Pakistan") OR LIMIT-TO (AFFILCOUNTRY , "Bangladesh") OR LIMIT-TO (AFFILCOUNTRY , "Japan") OR LIMIT-TO (AFFILCOUNTRY , "Kazakhstan") OR LIMIT-TO (AFFILCOUNTRY , "Kuwait") OR LIMIT-TO (AFFILCOUNTRY , "Palestine") OR LIMIT-TO (AFFILCOUNTRY , "Lebanon") OR LIMIT-TO (AFFILCOUNTRY , "Iraq") OR LIMIT-TO (AFFILCOUNTRY , "Uzbekistan") OR LIMIT-TO (AFFILCOUNTRY , "Macao") OR LIMIT-TO (AFFILCOUNTRY , "Bahrain") OR LIMIT-TO (AFFILCOUNTRY , "Sri Lanka") OR LIMIT-TO (AFFILCOUNTRY , "Brunei Darussalam") OR LIMIT-TO (AFFILCOUNTRY , "Afghanistan") OR LIMIT-TO (AFFILCOUNTRY , "Nepal") OR LIMIT-TO (AFFILCOUNTRY , "Timor-Leste") OR LIMIT-TO (AFFILCOUNTRY , "Myanmar")) AND PUBYEAR > 2009 AND PUBYEAR < 2025

Note. Retrieved 23 May 2026. Line breaks were added for readability; wording, operators, parentheses, field names, and the displayed year clause were otherwise preserved. The exported PY field, not the terminal displayed clause, was used to verify 2010–2026 coverage.

Table S2. ***Geographic filters and corresponding-author coverage***

Panel A. AFFILCOUNTRY values used in the Scopus query (n = 32)

No.	Scopus value	No.	Scopus value
1	China	17	Bangladesh
2	Saudi Arabia	18	Japan
3	Malaysia	19	Kazakhstan
4	Indonesia	20	Kuwait
5	India	21	Palestine
6	Hong Kong	22	Lebanon
7	Turkey	23	Iraq
8	Taiwan	24	Uzbekistan
9	United Arab Emirates	25	Macao
10	South Korea	26	Bahrain
11	Thailand	27	Sri Lanka
12	Singapore	28	Brunei Darussalam
13	Viet Nam	29	Afghanistan
14	Philippines	30	Nepal
15	Oman	31	Timor-Leste
16	Pakistan	32	Myanmar

Panel B. Asian countries/territories in the corresponding-author output (n = 34)

Location	Articles	Location	Articles
Afghanistan	2	Kyrgyzstan	1
Azerbaijan	1	Lebanon	7
Bahrain	6	Malaysia	79
Bangladesh	16	Nepal	1
Brunei	1	Oman	20
China	360	Pakistan	16
Cyprus	5	Philippines	30
Georgia	1	Qatar	1
Hong Kong	82	Saudi Arabia	95

Location	Articles	Location	Articles
India	97	Singapore	30
Indonesia	92	Sri Lanka	1
Iraq	8	Thailand	39
Japan	16	Turkey	93
Jordan	10	United Arab Emirates	47
Kazakhstan	14	Uzbekistan	2
Korea	59	Vietnam	8
Kuwait	8	Yemen	1

Note. Panel A reproduces the eligibility filters. Panel B reports corresponding-author locations, not study settings. Biblioshiny standardises several labels (for example, Korea and Brunei) differently from the Scopus query. Counts in Panel B are not intended to sum to 1,585 because the full corresponding-author output also includes non-Asian locations.

Table S3. ***Corpus construction and analytical configuration***

Stage	Parameter	Setting
Retrieval	Database and date	Scopus; 23 May 2026
Search	Fields	TITLE-ABS-KEY for AI and education concepts; affiliation-country filters
Eligibility	Document/source/language	Article; journal; English
Eligibility	Subject areas	Social Sciences or Psychology
Temporal scope	Publication years	2010–2026; 2026 partial through 23 May
Bibliometric corpus	Records	1,585 articles; 435 sources; 4,459 authors
Keyword field	Construction	Author keywords (DE) and Keywords Plus (ID) combined as KW_Merged
Keyword processing	Token form	Unigrams; no stemming
Co-word network	Configuration	50 leading KW_Merged nodes; Louvain communities; betweenness, closeness, and PageRank retained
Overall thematic map	Configuration	250 most frequent KW_Merged terms; minimum frequency 7; Louvain clustering; Callon centrality and density
Thematic evolution	Configuration	250 most frequent KW_Merged terms; minimum frequency 5; cut points after 2016 and 2020; Louvain clustering
Period-specific maps	Periods	2010–2016; 2017–2020; 2021–2026
TALL sample	Coverage	Random 50% target; realised n = 792 abstracts (49.97%); nested within the full corpus

Stage	Parameter	Setting
TALL aggregation	Analytical units	17 publication-year units; 'Documents = 17' does not mean 17 abstracts
TALL preprocessing	Pipeline	GUM-based tokenisation, lemmatisation, and part-of-speech processing
Topic modelling	Configuration	100 most frequent lemmas; K = 2–20 examined; five-topic interpretive solution retained; beta probabilities used for labels
Integration	Analytical role	Bibliometric structures interpreted first; TALL used to elaborate meanings without reassigning or validating clusters

Note. Settings were reconciled from the final article and the exported Biblioshiny and TALL reports.

Table S4. ***Annual scientific production and period membership***

Year	Articles	Analytical period	Coverage note
2010	4	Foundational	
2011	6	Foundational	
2012	3	Foundational	
2013	7	Foundational	
2014	5	Foundational	
2015	8	Foundational	
2016	6	Foundational	
2017	9	Transitional	
2018	11	Transitional	
2019	18	Transitional	
2020	22	Transitional	
2021	39	Recent acceleration	
2022	64	Recent acceleration	
2023	137	Recent acceleration	
2024	283	Recent acceleration	
2025	633	Recent acceleration	
2026	330	Recent acceleration	Partial through 23 May

Note. Period totals are 39 articles for 2010–2016, 60 for 2017–2020, and 1,486 for 2021–2026. The periods have unequal publication volumes and are used for descriptive mapping rather than causal staging.

Table S5. ***Complete 50-node co-word network membership and relational metrics***

Comm.	Keyword	Betweenness	Closeness	PageRank
C1	artificial intelligence	261.9063	0.020408	0.132763
C1	higher education	172.4619	0.019608	0.098916
C1	generative ai	32.7649	0.017544	0.052199
C1	chatgpt	20.9006	0.017857	0.052000
C1	educational technology	14.0237	0.016949	0.031229
C1	technology acceptance model	0.6922	0.012500	0.014197
C1	unified theory of acceptance and use of technology (utaut)	0.2871	0.012195	0.010829
C1	technology adoption	0.1728	0.012195	0.010537
C1	university students	0.1577	0.011765	0.009640
C1	ai literacy	0.0155	0.011236	0.009001
C1	academic integrity	0.0111	0.011364	0.008984
C1	chatbot	0.0523	0.011628	0.008430
C1	personalized learning	0.1569	0.012048	0.008285
C1	critical thinking	0.1423	0.012195	0.008053
C1	ethics	0.0224	0.011364	0.008022
C1	behavioral intention	0.0937	0.011765	0.007779
C1	bibliometric analysis	0.0225	0.011494	0.007317
C1	structural equation modeling	0.0135	0.011494	0.007278
C1	artificial intelligence (ai) in education	0.0357	0.011765	0.006823
C1	academic performance	0.0340	0.011628	0.006661
C1	english language teaching	0.0147	0.011494	0.006111
C2	education	52.7674	0.018519	0.061238
C2	learning	3.4329	0.013889	0.022760
C2	sustainability	1.2379	0.012821	0.017795
C2	student	1.4765	0.012987	0.016380
C2	sustainable development	0.1224	0.011628	0.011679
C2	china	0.1332	0.012195	0.009919
C2	perception	0.0613	0.011905	0.007861
C2	innovation	0.0216	0.011364	0.007424

Comm.	Keyword	Betweenness	Closeness	PageRank
C2	technology	0.0006	0.011111	0.006008
C3	students	110.3980	0.018868	0.071957
C3	teaching	28.2406	0.017241	0.040410
C3	learning systems	6.0645	0.014493	0.025674
C3	computer aided instruction	1.5906	0.012821	0.019318
C3	e-learning	1.9754	0.013514	0.018826
C3	chatbots	3.0354	0.014706	0.018445
C3	deep learning	1.2572	0.012658	0.014567
C3	curricula	0.8104	0.013514	0.013461
C3	large language models	0.5418	0.012195	0.012938
C3	intelligent tutoring system	0.4041	0.012048	0.011484
C3	high educations	0.2256	0.012195	0.010217
C3	generative artificial intelligence	0.1907	0.011905	0.009357
C3	online learning	0.1971	0.012346	0.009053
C3	self-regulated learning	0.1268	0.012195	0.008880
C3	motivation	0.1098	0.012500	0.008802
C3	language model	0.1299	0.011765	0.008540
C3	teaching & learning	0.0987	0.011905	0.008515
C3	student engagement	0.1235	0.012346	0.008302
C3	collaborative learning	0.1058	0.012195	0.007883
C3	college students	0.1389	0.011905	0.007253

Note. C1 = AI, higher education, generative AI, and adoption; C2 = Education, learning, and sustainability; C3 = Students, teaching, and learning systems. Community labels are interpretive summaries assigned after inspecting Louvain membership. Metrics describe network position and should not be interpreted as educational quality or effectiveness.

Table S6. ***Period-specific thematic-map metrics***

Period	Theme label	Centrality	Density	C rank	D rank	Frequency
2010–2016	students	2.247	64.139	7	7	75
2010–2016	computer aided instruction	5.597	56.595	9	5	93
2010–2016	teaching	3.402	99.901	8	9	52
2010–2016	e-learning	1.106	9.091	6	1	11
2010–2016	higher education	0.367	45.000	3	2	7
2010–2016	blended learning	0.778	50.000	5	3.5	5

Period	Theme label	Centrality	Density	C rank	D rank	Frequency
2010–2016	adaptive systems	0.000	62.500	1.5	6	4
2010–2016	elementary education	0.750	83.333	4	8	6
2010–2016	students' engagements	0.000	50.000	1.5	3.5	2
2017–2020	students	2.471	101.040	7	7	91
2017–2020	artificial intelligence	3.735	73.497	8	6	87
2017–2020	higher education	0.274	30.556	2	1	20
2017–2020	learning systems	1.358	153.586	6	8	38
2017–2020	deep learning	1.253	59.280	5	4	18
2017–2020	e-learning	1.062	50.000	4	2.5	6
2017–2020	forecasting	0.694	50.000	3	2.5	5
2017–2020	image enhancement	0.000	62.500	1	5	4
2021–2026	artificial intelligence	2.134	11.178	5	1	3228
2021–2026	education	1.680	12.687	3	2	1084
2021–2026	students	2.125	16.651	4	5	1451
2021–2026	large language models	0.284	13.630	1	3	81
2021–2026	human-ai collaboration	0.363	13.903	2	4	52

Note. C rank and D rank are within-period ranks of Callon centrality and density. Median values form the thematic-map quadrant thresholds. Themes close to a median should be interpreted as boundary positions rather than assigned a categorical developmental status.

Table S7. ***Complete thematic-evolution links between adjacent periods***

Panel A. Links from 2010–2016 to 2017–2020

Source theme	Destination theme	Shared keyword content	Weighted inclusion	Inclusion index	Occ.	Stability
blended learning--2010-2016	artificial intelligence--2017-2020	learning	0.400	0.500	2	0.0625
blended learning--2010-2016	higher education--2017-2020	blended learning	0.400	0.500	3	0.3333
computer aided instruction--2010-2016	learning systems--2017-2020	learning systems	0.368	0.091	14	0.0476
computer aided instruction--2010-2016	students--2017-2020	intelligent tutoring system;computer aided instruction;interactive learning environment;interactive learning environments;educational technology	0.319	0.091	16	0.0357
e-learning--2010-2016	e-learning--2017-2020	e-learning	0.667	1.000	11	0.5000
elementary education--2010-2016	students--2017-2020	elementary education	0.333	0.333	2	0.0500
higher education--2010-2016	higher education--2017-2020	higher education	0.714	0.500	5	0.3333
students--2010-2016	artificial intelligence--2017-2020	education;artificial intelligence	0.293	0.083	12	0.0385
students--2010-2016	deep learning--2017-2020	deep learning	0.111	0.250	2	0.0667
students--2010-2016	students--2017-2020	students;active learning	0.453	0.083	30	0.0345
students' engagements--2010-2016	students--2017-2020	students' engagements	1.000	1.000	2	0.0556
teaching--2010-2016	artificial intelligence--2017-2020	teaching	0.231	0.077	16	0.0370
teaching--2010-2016	e-learning--2017-2020	learning performance	0.333	0.500	2	0.0714
teaching--2010-2016	students--2017-2020	teaching & learning;teaching/learning strategy;curricula	0.173	0.077	5	0.0333

Panel B. Links from 2017–2020 to 2021–2026

Source theme	Destination theme	Shared keyword content	Weighted inclusion	Inclusion index	Occ.	Stability
artificial intelligence--2017-2020	artificial intelligence--2021-2026	artificial intelligence;pedagogy	0.287	0.067	23	0.0118
artificial intelligence--2017-2020	education--2021-2026	education;learning;curriculum;student;sustainability;sustainable development;innovation	0.448	0.067	15	0.0172
artificial intelligence--2017-2020	students--2021-2026	teaching	0.138	0.067	12	0.0120
deep learning--2017-2020	artificial intelligence--2021-2026	academic performance	0.111	0.250	2	0.0135
deep learning--2017-2020	students--2021-2026	deep learning;distance education	0.722	0.250	11	0.0139
e-learning--2017-2020	students--2021-2026	e-learning	0.667	0.500	4	0.0143
forecasting--2017-2020	students--2021-2026	forecasting	0.600	0.500	3	0.0143
higher education--2017-2020	artificial intelligence--2021-2026	higher education	0.900	0.500	18	0.0139
higher education--2017-2020	students--2021-2026	blended learning	0.100	0.500	2	0.0143
image enhancement--2017-2020	students--2021-2026	regression analysis	0.500	0.500	2	0.0143
learning systems--2017-2020	students--2021-2026	learning systems	0.395	0.091	15	0.0127
students--2017-2020	artificial intelligence--2021-2026	intelligent tutoring system;educational technology;teaching & learning	0.143	0.056	6	0.0114
students--2017-2020	students--2021-2026	students;computer aided instruction;experimental groups;curricula;control groups;motivation;scaffolds;self-regulated learning	0.637	0.056	31	0.0116

Note. Rows reproduce links exported by Biblioshiny. A link records shared keyword content between themes in adjacent periods; it does not establish causal succession or an unchanged substantive theme.

Table S8. ***TALL corpus diagnostics for the nested abstract sample***

Diagnostic	Value	Interpretive note
Documents	17	Publication-year units, not abstracts
Tokens	172,970	Processed abstract corpus
Types	8,920	Distinct surface forms
Lemma	7,635	Distinct lemmas
Sentences	7,437	Sentence units
Docs Avg Length in Chars	61,728	Per year-based unit
Docs SD Length in Chars	116,608	Unequal annual publication volume
Doc Avg Length in Tokens	10,175	Per year-based unit
Doc SD Length in Tokens	18,888	Unequal annual publication volume
Sent Avg Length in Tokens	22	Descriptive only
Sent SD Length in Tokens	12	Descriptive only
Sent Avg Length in Chars	133	Descriptive only
Sent SD Length in Chars	74	Descriptive only
TTR (%)	5.16	Type–token ratio
Hapax (%)	38.80	Single-occurrence forms
Guiraud Index	21.40	Lexical diversity diagnostic
Lexical Density	60.90	Percentage reported by TALL
Nominal Ratio	2.65	Nominal-style diagnostic
Gini Index	0.85	Frequency concentration diagnostic
Yule's K	84.90	Lexical repetition diagnostic

Note. The TALL sample comprised 792 abstracts (49.97% of the full corpus). The exported overview reports 17 documents because sampled abstracts were aggregated into publication-year units.

Table S9. ***Thirty most frequent lemmas in the TALL sample***

Rank	Lemma	Frequency	Rank	Lemma	Frequency
1	artificial_intelligence	2718	16	teacher	416
2	student	2140	17	design	392
3	learning	1620	18	model	381
4	study	1568	19	system	347
5	education	1367	20	group	345

Rank	Lemma	Frequency	Rank	Lemma	Frequency
6	research	848	21	university	339
7	finding	578	22	method	335
8	technology	564	23	approach	330
9	analysis	557	24	factor	324
10	use	510	25	development	315
11	tool	494	26	adoption	305
12	result	474	27	performance	302
13	intelligence	461	28	language	292
14	teaching	447	29	integration	291
15	datum	439	30	knowledge	287

Note. Underscores indicate multiword units retained by the TALL preprocessing pipeline. Frequencies describe lexical prominence and do not demonstrate educational effects.

Table S10. ***Topic-number diagnostics exported by TALL (K = 2–20)***

K	Log-likelihood	Perplexity	Cao–Juan	Arun	Deveaud
2	-180439.774	75.379	0.6465	1673.006	0.3011
3	-180468.115	75.430	0.6865	1599.744	0.2628
4	-180498.504	75.485	0.7024	1546.166	0.2685
5	-180511.343	75.509	0.7142	1504.308	0.2616
6	-180531.505	75.545	0.7243	1481.264	0.2689
7	-180548.501	75.576	0.6951	1440.722	0.2710
8	-180563.168	75.602	0.6989	1415.656	0.2732
9	-180589.239	75.650	0.6919	1392.833	0.2779
10	-180600.774	75.671	0.6841	1375.560	0.2769
11	-180610.783	75.689	0.6709	1355.120	0.2875
12	-180619.210	75.704	0.6677	1339.398	0.2926
13	-180641.908	75.745	0.6862	1326.921	0.2871
14	-180648.565	75.757	0.6803	1311.216	0.2917
15	-180654.593	75.768	0.6785	1295.642	0.3003
16	-180674.396	75.804	0.6840	1284.392	0.2967
17	-180679.119	75.813	0.6857	1270.594	0.3008
18	-180698.122	75.847	0.6860	1259.419	0.3008

K	Log-likelihood	Perplexity	Cao–Juan	Arun	Deveaud
19	-180701.513	75.853	0.6812	1247.715	0.3051
20	-180704.457	75.859	0.6803	1238.307	0.3068

Note. The diagnostics did not identify one common optimum: likelihood, perplexity, and Cao–Juan favoured smaller K, whereas Arun and Deveaud continued to change towards larger K. Five topics were retained as a parsimonious, semantically distinguishable interpretive solution after examining the beta term profiles. K = 5 should not be interpreted as a uniquely optimal solution.

Table S11. ***Five-topic solution: leading beta terms***

Topic	Interpretive label	Fifteen highest-probability terms (β)
Topic 1	University students' use and adoption	use (0.1615); student (0.1241); university (0.0524); model (0.0516); perceive (0.0440); factor (0.0398); knowledge (0.0371); study (0.0368); adoption (0.0358); have (0.0328); effect (0.0327); influence (0.0325); result (0.0310); significant (0.0299); intention (0.0293)
Topic 2	Learning design, teaching, and learner engagement	learning (0.1888); student (0.1285); base (0.0559); design (0.0528); teaching (0.0518); group (0.0496); system (0.0410); engagement (0.0316); genai (0.0314); improve (0.0301); support (0.0291); result (0.0279); show (0.0275); approach (0.0265); learner (0.0265)
Topic 3	Educational development, research, and digital skills	education (0.1759); high (0.1052); research (0.0715); analysis (0.0711); intelligence (0.0627); academic (0.0620); artificial intelligence (0.0543); development (0.0423); digital (0.0329); skill (0.0318); identify (0.0287); author (0.0251); framework (0.0249); science (0.0237); challenge (0.0234)
Topic 4	Teachers, language education, ethics, and AI literacy	artificial_intelligence (0.3209); tool (0.0594); study (0.0591); teacher (0.0501); language (0.0377); ethical (0.0347); context (0.0283); english (0.0283); need (0.0276); chatbot (0.0258); support (0.0256); literacy (0.0255); generative (0.0238); author (0.0227); participant (0.0226)
Topic 5	ChatGPT-specific opportunity and impact framing	study (0.0896); chatgpt (0.0818); technology (0.0815); educational (0.0738); enhance (0.0433); provide (0.0422); research (0.0400); finding (0.0351); potential (0.0350); impact (0.0342); datum (0.0341); human (0.0340); application (0.0291); offer (0.0289); future (0.0275)

Note. Terms are ranked within topic by beta probability. Labels were assigned interpretively after inspection of term distributions; they were not generated automatically and do not reclassify the Biblioshiny communities. Generic reporting terms remain visible to preserve the exported model.

Table S12. ***Analytical treatment of TALL outputs***

TALL output	Role in article	Reason for inclusion or exclusion
Overview	Diagnostic only	Used to report corpus size, aggregation, and lexical diagnostics; not treated as substantive evidence.
Morphological Features	Excluded from claims	Describes grammatical composition but does not answer the research questions about conceptual priorities.
WordsFreq	Included	Used to identify prominent educational actors, processes,

TALL output	Role in article	Reason for inclusion or exclusion
		implementation terms, and benefit-oriented vocabulary.
Keyness	Excluded from claims	Year-based units were highly unequal in size and no theoretically independent reference corpus was specified.
CorrespondenceAnalysis	Excluded from claims	Potentially dominated by unequal annual volumes; not required for elaborating the bibliometric structures.
WordNetwork and ThematicMap	Exploratory only	Not used as a second science map, avoiding duplicated mapping and any implication of comparative validation.
SVOTriplets	Excluded from claims	Exported pairs included publisher boilerplate such as right: reserve, and the displayed output did not consistently preserve a complete object slot.
EmbeddingSimilarity	Excluded from claims	Exploratory semantic proximity did not directly address the stated research questions.
SyntacticComplexity	Excluded from claims	Describes academic register rather than educational meaning; annual aggregation also followed unequal publication volume.
KChoice	Diagnostic	Used with semantic distinctiveness and interpretability to examine candidate topic solutions.
ModelEstim	Included	Beta probabilities supplied discriminating vocabulary for the five interpretive topics; theta values were not used for prevalence claims.
PolarityDetection	Excluded from claims	Lexicon classifications were context-sensitive; frequent academic and publisher terms risked being interpreted as attitude or evaluation.
EmotionAnalysis	Excluded from claims	Emotion labels were outside the research questions and could reflect lexicon behaviour and academic framing rather than authors' affect.

Note. Artefact screening identified publisher-related tokens such as elsevier, francis, and rightsreserve, and the frequent SVO pair right: reserve. Consequently, polarity, emotion, and SVO outputs were not used to infer educational effectiveness, ethical orientation, or affective stance. The article's benefit-oriented interpretation instead rests on lemma frequencies and topic beta profiles.

Supplementary Note S3. Interpretive safeguards

Centrality and density. These measures indicate external connectedness and internal coherence within the mapped keyword structure. They do not measure maturity, educational quality, intervention effectiveness, or research rigour.

Textual elaboration. TALL was nested within the bibliometric corpus and used after the Biblioshiny interpretation. It did not reproduce, validate, or reassign co-word communities.

Benefit-oriented vocabulary. Terms such as enhance, support, improve, potential, and impact record how abstracts frame AI. They do not demonstrate learning gains or establish effectiveness.

Geographic inference. Affiliation and corresponding-author locations describe scholarly participation. Neither identifies the location of data collection nor supports aggregate claims about Asian educational systems.

Reproduction sequence

Use the archived data. Download Version 2 from the DOI above. Use Dataset 1 for Biblioshiny and the realised Dataset 2 abstract corpus for TALL.

Reconstruct KW_Merged. Import the Scopus metadata, combine DE and ID, retain unigrams, and disable stemming.

Run the bibliometric analyses. Apply the settings in Table S3 for the 50-node co-word network, overall thematic map, period-specific maps, and thematic evolution.

Preserve temporal qualifications. Use 2010–2016, 2017–2020, and 2021–2026, while retaining the 23 May 2026 partial-year note and unequal period sizes.

Run TALL on the deposited abstract corpus. Retain year-based aggregation into 17 units and use the exported diagnostics, frequency output, and topic-model term probabilities.

Apply the stated integration rule. Interpret Biblioshiny first, then use TALL only to elaborate actors, processes, and framings without treating correspondence as validation.

Data citation

Fuadiy, M. R., Gurhan, E., Sholeh, M., Rozi, M. A. F., & Kholis, N. (2026). Artificial Intelligence in Education through Asian-affiliated Scholarship [Data set]. Mendeley Data (Version 2). https://doi.org/10.17632/59ns8h28rr.2

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