

CURRICULUM-ALIGNED BOUNDED DIFFERENTIATION IN AI-SUPPORTED INTERCULTURAL LEARNING: A MULTI-SITE STUDY ACROSS THREE EFL HIGHER EDUCATION CONTEXTS

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ABSTRACT	KEYWORDS
This study examines whether a curriculum-aligned methodology for AI-supported intercultural learning can operate across higher education institutions with comparable learning outcomes but different organisational conditions. The intervention was implemented within Country Studies courses at three Uzbek universities: Uzbekistan State World Languages University, Samarkand State Institute of Foreign Languages, and Namangan State Institute of Foreign Languages. The three programmes shared a four-credit disciplinary context and intercultural learning potential but differed in semester placement and independent-learning workload: 72 hours at the first two institutions and 60 hours at the third. A quasi-experimental design involved 316 students, with 158 in the experimental condition and 158 in the control condition. The methodology used bounded differentiation: common curricular coverage and minimum evidence across four dimensions of intercultural competence were retained, while students received required, recommended, and optional task pathways based on diagnostic profiles. Experimental-group post-test means were 79.2, 78.4, and 78.1 across the three institutions, compared with control-group means of 65.2, 64.8, and 64.7. Experimental gains were 18.4, 18.1, and 17.7 points, whereas control gains were 4.8, 4.7, and 4.6. The consistency of the pattern across 72-hour and 60-hour independent-learning arrangements suggests that curriculum alignment and bounded differentiation can support methodological portability without forcing institutional homogenisation. The study proposes a transferable design logic for AI-supported EFL learning in which technology remains subordinate to curricular outcomes, learner responsibility, diagnostic differentiation, and teacher facilitation.	Bounded differentiation; curriculum alignment; intercultural competence; EFL; AI-supported learning; independent learning; multi-site implementation; Country Studies

Introduction

One of the central challenges in educational technology research is portability. A pedagogical intervention may produce promising results in one course or institution yet fail when transferred to a different workload structure, timetable, assessment system, or student population. This problem is

especially relevant to AI-supported language education, where technical affordances are often discussed more extensively than the curricular conditions under which they must operate.

Intercultural competence adds a further layer of complexity. It is multidimensional, involving cultural knowledge, openness to alternative perspectives, communicative adaptation, and critical reflection (Byram, 1997; Deardorff, 2006). Consequently, a curriculum that merely allocates independent-study hours does not guarantee intercultural development. The decisive issue is what learners are asked to do with cultural content and whether task design, learner regulation, assessment, teacher facilitation, and technological support remain aligned.

Recent research confirms the potential of digitally mediated intercultural learning. AI-enabled COIL has produced positive intercultural outcomes (Sun, 2025), conversational agents have supported cultural inquiry and critical questioning (Hastomo et al., 2025), and human-AI collaborative designs have shown promise in EFL intercultural development (Ma & Shi, 2026). A recent systematic review of 24 digital intercultural interventions in higher education emphasises that outcomes depend on implementation logic, mechanisms, boundary conditions, and assessment alignment (Naranjo-Toro et al., 2026). These findings suggest that the next question is not simply whether AI can support intercultural competence, but how AI-supported methodologies can remain coherent when institutional conditions differ.

The present study addresses this issue through the concept of bounded differentiation. Bounded differentiation combines common curricular requirements with controlled flexibility. Students do not receive unrestricted choice, and institutions do not need to abandon approved workloads or course structures. Instead, core curriculum coverage, minimum evidence across competence dimensions, and assessment expectations remain stable, while students may receive different task recommendations based on diagnostic needs. This design aims to preserve both learner agency and institutional accountability.

The study examines a multi-site implementation of an AI-supported independent-learning methodology embedded in Country Studies courses at three higher education institutions in Uzbekistan. The institutions shared a common degree direction and four-credit Country Studies context but differed in semester placement and independent-learning hours. This natural variation created an opportunity to examine whether the same methodological principles could operate under both 72-hour and 60-hour independent-learning arrangements.

The research addresses three questions: (1) How can common intercultural outcomes be maintained when institutions allocate different amounts of independent-learning time? (2) Did the direction of experimental outcomes remain consistent across the three institutions? (3) Which design features appear essential for methodological portability without imposing identical learning pathways?

2. Conceptual framework

2.1. Curriculum alignment and intercultural performance

Constructive alignment requires intended outcomes, learning activities, and assessment to elicit corresponding forms of performance (Biggs, 1996). This principle is particularly important in Country Studies. If a curriculum expects learners to analyse cultural phenomena, compare perspectives, evaluate sources, and communicate across cultural contexts, independent assignments should require those actions rather than only the reproduction of factual topics.

The three participating programmes contained substantial cultural content and outcomes broader than country facts. Uzbekistan State World Languages University included multiculturalism, cultural comparison, media literacy, critical analysis, and comparison between English-speaking societies and Uzbekistan. Samarkand State Institute of Foreign Languages included analysis of cultural heritage and international relations, information evaluation, intercultural communication, and critical analysis of global issues. Namangan State Institute of Foreign Languages included cultural comparison and communication with specialists abroad. These commonalities made curriculum alignment feasible while leaving room for institutional variation.

2.2. Bounded differentiation

Autonomy does not require the removal of pedagogical structure. Holec (1981) defines autonomy in terms of learner responsibility for decisions concerning objectives, content, procedures, monitoring, and evaluation, while Little (1991) rejects the equation of autonomous learning with teacher absence. Sercu (2002) similarly argues that autonomous intercultural learning should retain intentional content, purposeful task design, and pedagogical scaffolding.

These principles informed bounded differentiation in the present methodology. All students were required to address common Country Studies content and produce evidence across the four dimensions of intercultural competence. Within these boundaries, diagnostic profiles guided recommendations for additional tasks. A learner with weaker behavioural-communicative performance could receive more situational judgement items, simulated dialogues, and clarification activities; a learner with weaker critical-reflective performance could receive more source-comparison, media-analysis, stereotype-challenge, and verification tasks.

Bounded differentiation was also necessary because institutional workloads differed. A fixed 72-hour task sequence would not fit a 60-hour programme, while a 60-hour sequence would underuse the workload available in the other two institutions. The solution was a task bank containing more activities than any single learner was expected to complete, organised into required, recommended, and optional pathways.

2.3. AI as a support component rather than the curriculum

The platform was designed as a structured environment integrating authentic websites, video, photographs, recordings, maps, media texts, cases, interactive exercises, simulations, reflection tools, portfolio evidence, and selected AI-supported functions. This distinction is important: AI was not treated as the curriculum, and platform use was not equated with intercultural competence.

AI support followed a learner-first sequence in which students attempted a task before receiving prompts, hints, alternative perspectives, simulated interaction, verification cues, or formative feedback. This approach is consistent with recent research favouring human-AI collaboration and guided scaffolding rather than unrestricted answer provision (Hastomo et al., 2025; Ma & Shi, 2026). The teacher remained responsible for curricular relevance, quality of core materials, monitoring, and strategic guidance.

3. Method

3.1. Sites and curricular conditions

The study was conducted in Country Studies courses within the 60230100 Philology and Language Teaching (English) degree direction at three higher education institutions. All three programmes

treated Country Studies as a mandatory four-credit course with a total workload of 120 hours, but the distribution of classroom and independent-learning time differed.

Table 1. Curricular conditions across participating institutions

Institution	Semester	Total hours	Classroom hours	Independent-learning hours
Uzbekistan State World Languages University	IV	120	48	72
Samarkand State Institute of Foreign Languages	III	120	48	72
Namangan State Institute of Foreign Languages	IV	120	60	60

3.2. Participants and design

The study used a quasi-experimental pre-test-post-test design with intact university groups. A total of 316 students participated: 158 in the experimental condition and 158 in the control condition. Individual students were not randomly reassigned across institutions or scheduled groups, allowing the intervention to remain embedded in normal university learning.

The institutional allocation was balanced within each site. Uzbekistan State World Languages University contributed 108 participants (54 experimental, 54 control), Samarkand State Institute of Foreign Languages contributed 104 (52 experimental, 52 control), and Namangan State Institute of Foreign Languages contributed 104 (52 experimental, 52 control).

Table 2. Participant distribution

Institution	Experimental	Control	Total
Uzbekistan State World Languages University	54	54	108
Samarkand State Institute of Foreign Languages	52	52	104
Namangan State Institute of Foreign Languages	52	52	104
Total	158	158	316

3.3. Implementation architecture

The implementation logic combined six practical module areas—Cultural Foundations; Interpretation and Comparison; Perspective and Attitude; Intercultural Communication; Behaviour and Adaptation; and Critical Reflection and Verification—with diagnostic profiling, differentiated task pathways, multimodal resources, an IC Portfolio, and teacher monitoring.

Required tasks ensured common Country Studies coverage and minimum evidence across all four IC dimensions. Recommended tasks provided additional practice according to the learner's diagnostic

profile. Optional tasks allowed further practice according to learner interest or identified need. Formative evidence was used to revise recommendations over time, and the IC Portfolio documented selected evidence of development.

Students at the first two institutions completed independent work within 72-hour curricular allocations, whereas students at Namangan completed the 60-hour allocation approved in their programme. The task bank was intentionally larger than any individual student's required workload, allowing the same pedagogical principles to operate without changing each institution's formal hours.

3.4. Outcome assessment

Intercultural competence was assessed through four dimensions: cognitive-cultural, affective-attitudinal, behavioural-communicative, and critical-reflective. Each dimension contained five indicators rated from 0 to 5 points, producing a maximum of 25 points per dimension and 100 points overall. The pre-test and post-test used parallel task forms based on the same construct and scoring structure.

Because the aim of the present article is institutional portability rather than a separate causal estimate of AI, the analysis focuses on site-specific descriptive trajectories and the consistency of direction across institutions. The overall experimental-control inferential analysis is reported in the parent study, but site-level means are interpreted cautiously because student-level clustered models were not available from the aggregate tables.

4. Results

4.1. Cross-institutional outcome pattern

The direction of change was consistent across all three institutions. Experimental-group pre-test means ranged from 60.3 to 60.8, and post-test means ranged from 78.1 to 79.2. Control-group pre-test means ranged from 60.1 to 60.4, and post-test means ranged from 64.7 to 65.2.

Table 3. Overall IC results by institution

Institution	Experimental pre	Experimental post	Experimental gain	Control pre	Control post	Control gain
Uzbekistan State World Languages University	60.8	79.2	+18.4	60.4	65.2	+4.8
Samarkand State Institute of Foreign Languages	60.3	78.4	+18.1	60.1	64.8	+4.7
Namangan State Institute of Foreign Languages	60.4	78.1	+17.7	60.1	64.7	+4.6

The experimental gains were therefore highly similar across sites: 18.4 points at Uzbekistan State World Languages University, 18.1 at Samarkand State Institute of Foreign Languages, and 17.7 at Namangan State Institute of Foreign Languages. Control gains were likewise similar but much smaller: 4.8, 4.7, and 4.6 points respectively.

The consistency of the pattern is notable because one institution operated with a 60-hour independent-learning allocation while the other two operated with 72 hours. The results do not establish that workload differences are irrelevant; rather, they show that the methodology could be implemented without forcing identical hours or identical task sequences.

4.2. Overall outcome in the pooled sample

Across all institutions, the experimental group increased from 60.5 to 78.6, while the control group increased from 60.2 to 64.9. The post-test difference was statistically significant, $t = 14.48$, $p < .001$, with Cohen's $d = 1.63$. Because the present analysis concerns cross-site implementation, this pooled result is treated as supporting context rather than evidence that each institutional difference is independently significant.

The developmental-level distribution also shifted more strongly in the experimental condition. The proportion of students at sufficient or high levels increased from 36.7% to 76.6% in the experimental group and from 35.4% to 44.9% in the control group. This pattern suggests that the methodology affected the distribution of performance, not only the mean.

5. Discussion

The principal finding is not simply that the experimental group improved, but that the direction and approximate magnitude of improvement were consistent across three institutional contexts. This matters for implementation research because the methodology was not applied to artificially standardised programmes. The institutions retained their approved semester placement, classroom hours, independent-learning hours, and local organisational arrangements.

The results support curriculum alignment as a central mechanism of portability. Country Studies content was not replaced by an external intercultural course. Instead, existing themes such as education, institutions, media, customs, social life, and cultural comparison were transformed into tasks requiring interpretation, comparison, contextual decision-making, source evaluation, and reflection. This design reduced the tension between innovation and curriculum compliance.

Bounded differentiation appears to be the second important mechanism. Uniform task sequences can satisfy administrative workload requirements while failing to respond to different learner profiles. Conversely, unrestricted individualisation can weaken common curricular coverage. The required-recommended-optional structure offered an intermediate solution: common outcomes and minimum evidence remained fixed, but students could receive different additional pathways based on formative and diagnostic information.

This finding is consistent with theories of learner autonomy that define independence as responsibility rather than isolation (Holec, 1981; Little, 1991) and with Sercu's (2002) argument that autonomous intercultural learning requires purposeful content and scaffolding. In practical terms, learners could exercise choice without avoiding dimensions in which they needed development.

The third mechanism is the separation of technology from pedagogy. The platform supported access, organisation, simulation, feedback, and differentiation, but curricular outcomes and assessment criteria were defined independently of the technology. This distinction is important in light of current AI research. Sun (2025), Ma and Shi (2026), and Hastomo et al. (2025) all show positive possibilities for AI-supported intercultural learning, yet the most defensible interpretation of these interventions concerns the pedagogical condition as a whole, not the isolated causal effect of a tool.

The present findings therefore complement recent systematic evidence. Naranjo-Toro et al. (2026) show that digital intercultural interventions vary widely in modality and implementation, with effectiveness linked to mechanism and assessment alignment. The current study provides a concrete example of how one implementation logic can be preserved across sites: common competence targets, bounded learner choice, teacher facilitation, multimodal task options, learner-first AI scaffolding, and performance-based assessment.

The 60-hour and 72-hour comparison is especially useful. It would be incorrect to infer that twelve hours of workload difference had no educational effect; the available aggregate data cannot isolate that factor. However, the similar institutional trajectories indicate that the methodology did not require a single fixed workload to remain functional. The larger task bank acted as a buffer, allowing institutions to preserve approved hours while students pursued comparable intercultural outcomes.

Portability also depends on what is not standardised. The study did not require identical sequences for every student, identical numbers of optional tasks, or identical institutional calendars. This flexibility is not methodological weakness when core constructs, minimum evidence, scoring criteria, and curriculum coverage remain stable. In this sense, bounded differentiation can be understood as controlled variation around a common pedagogical core.

6. Implications for AI-supported EFL curriculum design

First, AI-supported innovation should begin with curriculum outcomes rather than with a tool. Before selecting an AI function, educators should identify the intercultural performance expected from students and the evidence by which that performance will be assessed.

Second, independent-learning hours should be treated as pedagogical capacity rather than as a fixed list of homework topics. A task bank can contain more activities than any one learner must complete, allowing required common tasks to coexist with diagnostic recommendations and optional enrichment. Third, learner choice should be bounded. Students need agency, but all dimensions of the intended competence require minimum coverage. Choice is most defensible when alternatives are pedagogically equivalent and linked to diagnostic evidence.

Fourth, AI should provide graduated support after learner effort. Prompting, alternative perspectives, simulation, source-verification cues, and formative feedback can extend learning, but unrestricted answer provision weakens the logic of independent reasoning.

Fifth, assessment should remain performance based. Platform activity, time-on-task, or frequency of AI use should not be treated as evidence of intercultural competence. Evidence should come from what students can interpret, justify, communicate, verify, and revise.

7. Limitations

The study used intact groups rather than random assignment, and site-level results are based on aggregate means rather than multilevel modelling. The similarity of institutional trajectories therefore supports practical applicability within the participating contexts but does not establish statistical equivalence across institutions or unrestricted generalisability to other universities.

The participating programmes were all located in Uzbekistan and shared an English philology context. Replication in different countries, disciplines, proficiency levels, and credit structures is required. Future research should retain student and classroom identifiers, test site-by-condition interactions, and

examine whether the same bounded-differentiation architecture remains effective when institutional differences are larger.

The intervention also combined multiple elements: transformed tasks, diagnostic differentiation, self-regulation, teacher facilitation, multimodal resources, platform functions, and AI scaffolding. The design intentionally evaluated this pedagogical system, so the present study does not isolate the contribution of any single component.

8. Conclusion

This multi-site study suggests that an AI-supported intercultural learning methodology can remain coherent across institutions without requiring curricular homogenisation. The participating programmes differed in semester placement and independent-learning workload, yet experimental outcomes followed a highly similar direction across all three sites.

The central design principle was bounded differentiation: common curriculum coverage, competence targets, assessment criteria, and minimum evidence were held constant, while learners could follow different recommended and optional pathways within approved institutional workloads. The resulting structure reconciled learner agency with curriculum accountability.

For AI-supported EFL education, the broader implication is that scalability should be understood as methodological portability rather than technological replication. A platform becomes educationally transferable when it can adapt to institutional conditions while preserving the same pedagogical core: contextualised intercultural tasks, learner responsibility, diagnostic differentiation, teacher guidance, controlled AI support, and performance-based evidence of learning.

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