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The friction paradox: generative AI and the educational value of difficulty in education abroad

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Article

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Abstract

Education abroad is expected to develop intercultural competence, independence and the capacity to interpret unfamiliar perspectives, yet mobility does not by itself produce these outcomes. Generative artificial intelligence now sits inside the intercultural encounter rather than beside it: students translate interactions, interpret local behaviour, compose messages and obtain reassurance through systems that are continuously available. Immersion and mediation are therefore no longer alternatives to be traded off but conditions of the same experience, which is why institutional debates about whether AI should be permitted have proved unproductive. This article extends the desirable-difficulties and productive-failure literatures, developed around structured academic tasks, to difficulty arising within relational encounters, and extends recent arguments against frictionless AI to the specific case of cross-border mobility. It advances two claims. The friction paradox holds that generative AI can widen access to education abroad while weakening one of its principal learning mechanisms. The mediation gradient holds that what matters educationally is the degree of interpretive agency transferred to the system rather than the volume of use. A supporting taxonomy separates friction classified by educational function from friction generated by the technology itself, whose educational status depends on whether it is detected and contested. Five propositions follow, together with implications for programme design, assessment and staff development. Because emerging evidence links AI use to improved international-student adaptation, the framework is offered as a set of competing hypotheses distinguishing adaptation from intercultural learning, and as an agenda for a field that must now decide which difficulties are obstacles to remove and which are the mechanism by which mobility educates.

1. Introduction

Education abroad is often presented as transformative by design. Students cross national and cultural boundaries, encounter unfamiliar ways of living and learning, and are expected to return with greater independence, intercultural competence and global awareness. The assumption is attractive but incomplete. Mobility provides the conditions for learning; it does not guarantee that learning will occur. Students can live abroad while remaining socially, linguistically and intellectually enclosed within familiar networks. Conversely, a relatively brief period abroad can be developmentally significant when students encounter unfamiliar perspectives, attempt difficult interactions and receive support in reflecting on what those experiences mean.

This distinction has become increasingly important as education-abroad participation has diversified in duration, purpose and programme design. Reviews of short-term study abroad identify a wide range of reported outcomes but also substantial variation in programme quality, conceptualisation and research design (Bradly and Iskhakova 2023; Goldstein 2022; Iskhakova and Bradly 2022). Recent empirical work similarly indicates that intercultural learning is associated not simply with geographical displacement but with cultural novelty, host-community interaction, structured preparation, guided reflection and cultural mentorship (Boonen et al. 2021; Chwialkowska 2020; Gibson et al. 2023; Wilczewski et al. 2023).

Generative artificial intelligence changes the conditions under which these experiences now take place. A student arriving in an unfamiliar country can ask a conversational system to translate a landlord's message, explain why a classmate behaved in a particular manner, draft an email to a professor, summarise local expectations, rehearse a difficult conversation, recommend an appropriate response to a cultural misunderstanding or provide reassurance during a period of loneliness. The same system can generate academic work, explain readings, plan travel, identify services and remain available at any hour.

These applications can materially improve access. Machine-assisted translation can expand the communicative repertoire of multilingual learners rather than merely compensate for linguistic deficiency (Kelly and Hou 2022). Qualitative evidence from international students indicates that AI tools reduce language anxiety and support adaptation and self-directed learning, while raising concerns about unequal access and overreliance (Kadriu and Jemini Gashi 2026). For students facing language barriers, anxiety, disability, discrimination or limited institutional support, such assistance may make participation possible where it would otherwise be restricted. Human-centred approaches to educational AI therefore rightly emphasise inclusion, agency, privacy and pedagogical purpose rather than blanket prohibition (Chan 2023; Miao and Holmes 2023).

Yet the educational value of study abroad has historically been associated with precisely those moments when students cannot proceed automatically. They must negotiate meaning, tolerate uncertainty, recognise that familiar assumptions do not travel intact and reconsider their interpretation of another person or social practice. Transformative-learning theory describes such disruption as a possible catalyst for examining frames of reference (Mezirow 1991, 2000). Experiential-learning theory similarly treats experience as educational when it is connected to reflection, conceptualisation and subsequent action rather than merely undergone (Kolb 1984).

Generative AI may now intervene at every point in that process. It can scaffold an encounter, but it can also perform the encounter on the student's behalf. It can prompt reflection, but it can also provide an immediate interpretation that closes reflection prematurely. It can connect a student to local people, or become a socially undemanding substitute for them. It can remove an arbitrary barrier, or remove the need to practise a capability that the programme was intended to develop.

The literature on AI in higher education has primarily concentrated on academic integrity, assessment, efficiency, policy and the redistribution of authority between teachers, learners, institutions and technological systems (Bearman et al. 2023; Chan 2023; Farrokhnia et al. 2024; Kasneci et al. 2023; Tlili et al. 2023). Education-abroad research, meanwhile, has examined immersion, cultural novelty, adjustment, reflection and intercultural development, and has begun to consider technological mediation: work on technology, reflection and noticing during short-term study abroad shows that digital tools can support intercultural learning when deliberately structured (Lomicka and Ducate 2021), while research on international students' smartphone use demonstrates that personal technologies can simultaneously support emotional management, language learning and adaptation while changing the character of immersion (Magnat and Guichon 2023). Generative AI substantially intensifies this

mediation because it does not merely provide access to information. It interprets, recommends, composes, reassures and converses.

The argument starts from an empirical observation rather than a normative one. Education abroad has been theorised around a distinction that no longer describes the experience: immersion in an unfamiliar place, set against mediation by technologies understood as standing outside it. Once a conversational system is present within the encounter itself — translating as the exchange occurs, proposing what a gesture meant, supplying the sentence the student then speaks aloud — the immersive and the mediated are not competing states but the same state. Scholars of digital education have made this point in general terms: digital and non-digital dimensions of experience are no longer separable into domains that can be traded against one another (Jandrić et al. 2018), and technology and teaching are mutually constitutive rather than separable (Fawns 2022), an entanglement recent work extends to students' encounters with artificial intelligence specifically (Fawns et al. 2026). The present paper takes that inseparability as its starting point and asks what follows for difficulty. If mediation cannot be subtracted from immersion, the educational question is not how much technology is present but which difficulties it dissolves and which it leaves standing.

This paper addresses the resulting theoretical gap. It asks: how does generative AI alter the relationship between difficulty, human engagement and intercultural learning in education abroad?

The paper makes two primary theoretical contributions, supported by two analytical devices and one practical principle. The primary contributions are the friction paradox, which holds that generative AI can simultaneously widen access to education abroad and weaken one of its principal learning mechanisms; and the mediation gradient, which organises AI use by the degree of interpretive agency transferred rather than by volume, and so explains why similar quantities of use may produce different outcomes. Supporting these are a two-dimensional taxonomy separating friction classified by educational function from friction classified by technological origin, and an immersion heuristic for programme design. From these follows the friction-conversion principle, a practical implication rather than a further theoretical construct. Five propositions are stated so that the framework can be tested, qualified or refuted.

The argument is not that students must struggle in order to deserve the benefits of studying abroad. It is that educational institutions must distinguish between barriers that exclude students and encounters that develop them. Removing the former is an obligation. Removing the latter without replacing their developmental function may leave education abroad more convenient but less educational.

2. Conceptual Foundations and Scope

2.1 The educational status of difficulty

The claim that difficulty can be educationally productive is not new, and the present argument builds on an established lineage rather than proposing one. Bjork and Bjork (2020) describe desirable difficulties: conditions that slow apparent progress during learning while improving long-term retention and transfer.

Kapur (2008) demonstrated productive failure, showing that learners who struggled with complex problems before receiving instruction subsequently outperformed those given direct instruction first, despite poorer performance during the struggle itself. Both literatures establish a principle central to this paper: the subjective experience of ease is an unreliable indicator of learning, and interventions that reduce effort may also reduce the learning that effort produces.

This concern has recently been extended to generative AI. Zhu et al. (2026) distinguish autonomous offloading, in which AI scaffolds a task while the user retains cognitive agency, from dependent offloading, in which core thinking is delegated to the system, and show that frequency of use is a poor discriminator because both modes deliver comparable immediate benefits while carrying different downstream associations. That distinction is directly relevant here and is developed further in Section 5.3.

The argument that reducing friction may carry costs has recently been advanced in general terms. Zohar et al. (2026) contend that artificial intelligence increasingly removes difficulty from intellectual work and from social relationships, and that moderate friction supports learning, motivation, meaning and human connection. The present framework shares that premise and extends it in three respects. It examines relational difficulty arising within cross-cultural encounters rather than difficulty in intellectual tasks or companionship generally; it separates friction classified by educational function from friction generated by the technology itself, which the general argument does not distinguish; and it proposes that AI mediation may improve adaptation while simultaneously weakening the interpretive processes through which intercultural learning occurs, so that the costs of frictionless support may be invisible in precisely the outcomes institutions measure.

These arguments have been developed largely around structured academic tasks with clear performance criteria, in which the difficulty inheres in the material. The present paper extends them to settings in which difficulty arises within a relational encounter rather than from a bounded academic task. In education abroad, the productive difficulty is not a problem set but an ambiguous social norm, an unfamiliar convention or a misunderstanding that must be repaired through interaction with another person who has their own interests, interpretations and patience.

Three features distinguish this case. First, the difficulty is relational: it can be resolved only through engagement with people, not through additional effort applied to a static object. Second, it is interpretively open: unlike a mathematics problem, an intercultural encounter rarely has a single correct reading, so part of the learning consists in holding several interpretations simultaneously. Third, avoidance is socially invisible: a student who avoids a difficult conversation incurs no immediate penalty and may appear to be coping well.

These features mean that findings from task-based research cannot simply be transferred to the education-abroad context. They also mean that the stakes of AI mediation are higher. A system that answers a comprehension question substitutes for a cognitive operation. A system that composes a message, interprets a stranger’s behaviour and provides companionship substitutes for a relationship.

2.2 Scope and status of the argument

This is a concept paper. It does not report a systematic or exhaustive review, and no claims are made about the completeness of the literature discussed. Sources are drawn purposively from education-abroad and international-student research, transformative and experiential learning, intercultural competence, generative AI in higher education, machine translation and technology-mediated language learning, cognitive offloading, and human–AI interaction. They are used to construct and defend a conceptual framework rather than to summarise the state of a field.

The framework should accordingly be judged by three criteria: its internal coherence; its capacity to distinguish cases that existing accounts conflate; and the empirical propositions it generates. Those propositions are stated explicitly in Section 6 so that the framework can be tested, qualified or refuted.

The scope is bounded in a second respect. The paper concerns learning during education abroad. It does not address algorithmic guidance about whether or where to study internationally, nor AI in admissions, recruitment or intermediary services, which raise distinct questions of equity and governance.

2.3 Which students, and which promise

“Education abroad” is used here to denote cross-border student mobility undertaken for educational purposes, but the term covers populations whose relationship to the transformation promise differs, and the distinction matters for how the framework should be applied.

Short-term and semester programmes, including faculty-led and exchange mobility, typically carry explicit experiential and intercultural learning objectives. Transformation is not merely hoped for; it is the stated rationale, and programmes are designed and evaluated against it. Full-degree international mobility, by contrast, is organised principally around academic qualification and longer-term adaptation; intercultural development may occur but is rarely the formal objective, and students face sustained adjustment demands over years rather than weeks.

This distinction has direct evidential consequences. The empirical literature on AI and international students discussed in Section 4.6 concerns predominantly full-degree populations, whereas the transformation promise on which this paper turns is strongest in structured programmes. The framework is proposed as applicable to both, but the balance among harmful, productive and synthetic friction is expected to differ: full-degree students face more sustained harmful friction arising from administrative, linguistic and financial systems, while structured programmes concentrate productive friction into short, intensively supported periods. Section 8 treats this variation as an empirical question rather than an assumption.

2.4 Positionality

The argument is developed by an author whose professional background is in advising students and families on international higher education before departure. This vantage point foregrounds the expectations and promised outcomes through which students and families evaluate education abroad, and the substantial financial and personal commitments made on the strength of them. It does not substitute for the perspectives of in-country educators, host communities or programme participants. The framework therefore draws on published research from those settings and is offered for empirical testing across them.

3. Why Mobility Does Not Automatically Produce Transformation

3.1 Exposure is not engagement

Early models of education abroad were often built around an implicit contact assumption: placing students in another cultural environment would expose them to difference and thereby produce intercultural development. Subsequent research has challenged this assumption. Students may remain largely within co-national friendship groups, interact mainly with other international students or interpret host practices through existing stereotypes. Physical presence in another country is therefore neither equivalent to cultural immersion nor sufficient for intercultural learning.

Engle and Engle (2003) argued that programmes vary in the depth of their cultural and linguistic integration, and Woolf (2007) questioned romanticised accounts in which travel is presumed to broaden students regardless of what they do while abroad. The collection assembled by Vande Berg, Paige and Lou (2012) made the point most directly, documenting the gap between what students are assumed to learn abroad and what they demonstrably learn, and arguing that intervention in the experience is what closes it. Chwialkowska (2020) found that cross-cultural learning depends on programme and student-level conditions that encourage participants to leave familiar environments, while reviews by Goldstein (2022), Iskhakova and Bradly (2022) and Bradly and Iskhakova (2023) demonstrate both the potential of study abroad and the heterogeneity of its outcomes. The relevant mechanism is therefore not geographical distance but the student's engagement with unfamiliar people, practices and interpretations.

3.2 Disorientation as a possible learning mechanism

Transformative-learning theory provides one explanation for why unfamiliar encounters can become educationally important. Adults typically interpret experience through established frames of reference. A disorienting event may expose the inadequacy of those frames and initiate critical reflection, dialogue and perspective transformation (Mezirow 1991, 2000).

Disorientation is not automatically transformative. It can produce withdrawal, defensiveness or stereotype reinforcement. Mälkki (2010) emphasised that reflection can be emotionally difficult because it threatens assumptions connected to identity and belonging. The educational task is therefore not to

maximise discomfort. It is to create or recognise manageable disturbances and support students in interpreting them.

Recent education-abroad research provides empirical support for this distinction. Gibson et al. (2023) found that cultural mentorship was especially important for intercultural learning, and that heightened moments of disorientation offered strong learning potential when experienced facilitators guided reflection. Their formulation of guided disorientation is central to the present argument: productive learning lies neither in protecting students from all uncertainty nor in leaving them alone within it.

Preparation also matters. Boonen et al. (2021) found that intercultural-communication courses and interaction with international staff before mobility could strengthen intercultural outcomes during study abroad. This suggests that students' capacity to learn from unfamiliarity can be intentionally developed rather than assumed.

3.3 Cultural novelty, language and social interaction

Cultural difference is not experienced uniformly. Wilczewski et al. (2023), using data from international students in five host countries, showed that subjective cultural novelty interacts with cultural intelligence, language skills, time in the host country and socialisation with domestic students. Difference can be stimulating, confusing or isolating depending on the student's capabilities and social environment.

Language is both an access condition and a site of learning. Limited proficiency can prevent participation, create safety risks and reduce the capacity to form relationships; attempting to communicate through uncertainty develops pragmatic awareness, confidence and sensitivity to how meaning is negotiated. Kinginger (2013) showed that language development abroad is connected to identity, access and participation rather than mere exposure to input, and the account of intercultural communicative competence in Byram (1997) makes the same point structurally: linguistic accuracy is one component alongside attitudes, knowledge, skills of interpretation and critical cultural awareness exercised in interaction. The educational value of communication cannot therefore be measured by whether information was transmitted. A technically perfect translation may resolve the immediate task while removing the need to notice tone, negotiate meaning or remain present within an imperfect human exchange.

3.4 Reflection and mentorship

Experiential learning requires movement between experience and reflection (Kolb 1984). In intercultural education, students must learn not only that practices differ but also that their initial interpretation may reflect culturally situated assumptions. Deardorff's (2006) process model treats intercultural competence as an iterative relationship among attitudes, knowledge, internal shifts and appropriate external behaviour, while Bennett's (1993) developmental model describes movement from ethnocentric to ethnorelative orientations as a staged process rather than an automatic consequence of contact.

Faculty and cultural mentors are important because they can resist two common errors. The first is romanticisation: treating every difficulty as inherently developmental. The second is premature closure: offering a fixed cultural explanation that prevents further inquiry. Effective mentorship helps students generate alternative interpretations, consider power and context, and test assumptions through subsequent interaction. Recent work on educator development reinforces the importance of relationship-rich cultural mentoring and the capacity of faculty to guide intercultural learning rather than merely supervise travel (Sherman et al. 2024).

3.5 Adaptation and intercultural learning are different outcomes

Because the argument advanced below turns on a distinction between outcomes, the relevant constructs should be separated explicitly. International-student research has long distinguished psychological adjustment, concerning emotional wellbeing and satisfaction during cross-cultural transition, from sociocultural adaptation, concerning the behavioural competence to manage everyday demands in the host environment (Searle and Ward 1990). Academic adaptation, concerning performance and integration within the host institution, is frequently treated as a third domain.

Intercultural competence is a further and distinct construct, encompassing attitudes, knowledge and skills of interpretation exercised in interaction (Byram 1997; Deardorff 2006), and developing through identifiable stages rather than automatically (Bennett 1993). Transformative learning is more demanding still, requiring revision of the frames of reference through which experience is interpreted (Mezirow 1991, 2000).

These constructs are related but not interchangeable. A student may become behaviourally competent in the host environment while interpreting it through unchanged assumptions; conversely, a student may experience significant frame revision while continuing to find daily life difficult. The distinction is well established in the international-student literature. What this paper adds is the claim that generative AI mediation may drive these outcomes apart more sharply than before, because a system can supply behavioural competence — the correct phrase, the appropriate response, the plausible explanation — without the interpretive work through which competence has conventionally been acquired.

4. Generative AI as a New Layer of Mediation

4.1 From information retrieval to interpretive assistance

Earlier digital technologies allowed international students to search for information, communicate with home and use machine translation. Generative AI extends these functions by producing context-sensitive and conversational responses. It can infer what the student is trying to achieve, propose language, simulate another person’s perspective and provide an apparently coherent explanation.

This is not a simple increase in technological convenience. It changes the locus of interpretation. Bearman et al. (2023) argue that AI alters authority in higher education by redistributing agency among students, teachers, institutions, corporations and machines. In education abroad, interpretive authority may shift away from the host encounter itself and towards a system trained on decontextualised textual representations of culture.

Consider a student who perceives a professor's response as rude. Several forms of AI assistance are possible: translating the professor's words; identifying alternative meanings; drafting a respectful follow-up question; declaring that people in the host culture commonly behave in that manner; advising the student to avoid further interaction; or composing the entire response and sending it with minimal student involvement. These actions differ educationally even when they produce the same immediate outcome. The first three may support participation. The latter three may close inquiry, reproduce stereotypes or substitute the student's communicative agency.

4.2 Accessibility and capability expansion

A critical account of AI mediation must avoid treating unaided struggle as pedagogically superior. Students enter education abroad with unequal linguistic, psychological, physical, financial and social resources; some arrive with extensive preparation and institutional support, others face unfamiliar systems with little guidance. Machine translation can expand participation when incorporated critically and flexibly into a multilingual repertoire (Kelly and Hou 2022), and a systematic review of generative AI in language classrooms reports benefits for practice opportunity, feedback and learner confidence alongside concerns about accuracy and dependence (Lee et al. 2025). From a capability perspective the question is not whether students use technology but whether that use expands their genuine opportunities to participate, communicate and learn, which is also the emphasis of human-centred guidance on educational AI (Miao and Holmes 2023).

The danger arises when institutions confuse the removal of a barrier with the removal of an educational activity. Translating an emergency medical instruction and translating every informal conversation are not pedagogically equivalent. The first protects access and safety. The second may gradually reduce opportunities for language development and relationship formation.

4.3 Cognitive and interpretive offloading

Cognitive offloading occurs when people modify a task or use external resources to reduce internal processing demands (Risko and Gilbert 2016). External tools are not inherently detrimental. Written language, maps and calculators all redistribute cognitive work. The educational consequences depend on what is offloaded and whether the learner remains engaged in the reasoning that the activity is intended to develop. Zhu et al. (2026) make this precise for generative AI, distinguishing autonomous from dependent offloading and demonstrating that the two are not separable by frequency of use.

Generative AI permits a broader form of offloading because it can assume not only memory or calculation but interpretation. A student may outsource deciding what another person meant, identifying

the culturally appropriate response, generating questions, evaluating competing explanations, composing language, or deciding whether an interaction warrants further attention.

This may be described as interpretive offloading: the relational analogue of the dependent offloading identified by Zhu et al. (2026), and of the fluency illusion Bjork and Bjork (2020) describe in task-based learning. It is especially consequential in education abroad because interpreting ambiguity is itself part of intercultural learning. When AI provides a fluent answer immediately, the student may experience an illusion of understanding without having examined the assumptions beneath the answer.

The well-established “Google effect” showed that access to external information can change what people remember and how they allocate memory (Sparrow et al. 2011). Generative AI extends this logic from remembering information to generating explanations and responses. The concern is not that students will remember fewer facts about a host country. It is that repeated substitution may reduce practice in noticing, tolerating and investigating ambiguity.

4.4 Social substitution and frictionless enclosure

Generative AI also performs a relational function. Social chatbots prompt self-disclosure and develop relationship-like qualities through availability, responsiveness and perceived non-judgement (Skjuve et al. 2021), and may offer immediate reassurance to students who are lonely or distressed. Crawford et al. (2024) nonetheless warn that substituting AI for human interaction in higher education may carry costs for belonging, wellbeing and student success. The implications are greater abroad, where relationships with host-country students, teachers, neighbours and community members are not merely sources of comfort but the substance of the educational experience. A student who repeatedly turns to a system for emotional reassurance, cultural explanation and conversational practice may feel more secure while becoming less likely to risk imperfect interaction with people. The result is a form of frictionless enclosure: the student is physically abroad but moves through the environment behind a mediating layer that answers before the environment can.

4.5 AI can also deepen learning

Substitution is not the only possible use. AI can increase reflection when designed and prompted to resist premature answers, asking the student what evidence supports an initial interpretation, what else a behaviour might mean, how the other person would describe the encounter, what could be asked directly, which parts of an explanation require verification, and how the interaction challenged prior expectations.

Empirical work supports this possibility with important conditions attached. Drewelow (2026) found that ChatGPT could foster cognitive flexibility and perspective shifting in the development of intercultural competence, but that this depended on prompt design, tolerance of ambiguity and students’ willingness to negotiate rather than accept the system’s cultural positioning. AI-enabled collaborative international learning has similarly shown potential to support intercultural competence when embedded within structured human collaboration rather than used as an isolated answer system (Sun 2025), and meta-

analytic evidence suggests generative AI can support learning and motivation, with effects depending on implementation (Liu et al. 2025).

The central distinction is therefore not between AI use and non-use. It is between AI that returns the learner to the world and AI that completes the world-facing task for the learner.

4.6 The emerging evidence base points in a different direction

Intellectual honesty requires acknowledging that the growing empirical literature on generative AI and international students has so far reported largely positive associations. Ma et al. (2025), applying a cognitive-affective model, found generative AI use associated with improved sociocultural adaptation. Zhu and Yang (2026), using a stimulus-organism-response framework, similarly report that AI-mediated support contributes to cross-cultural adaptation. Kadriu and Jemini Gashi (2026) document international students describing AI as supporting cultural adaptation, academic success and self-directed learning. Most challenging of all for the present argument, Qu and Chen (2026) found that voice-based generative AI interlocutors improved intercultural communicative competence and reduced speaking anxiety while increasing learners' willingness to take communicative risks, though learners noted the absence of paralinguistic cues.

These findings are not incidental. They are the argument's principal empirical challenge, and the Qu and Chen result in particular suggests that AI can generate productive preparatory friction — simulated encounters demanding real interpretive effort — especially where anxiety would otherwise prevent participation altogether. The framework must accommodate this: simulated interaction is not automatically substitutive.

Three considerations nonetheless suggest the question is not settled. First, adaptation and intercultural learning are distinct outcomes, as Section 3.5 sets out, and the studies above principally measure the former. A student whose difficulties are efficiently managed may adapt well while revising few interpretive frames, and the friction paradox predicts precisely this divergence (Proposition 5).

Second, these studies measure AI use largely by frequency or perceived helpfulness, without distinguishing the degree of interpretive agency transferred or the timing of use set out in Section 5.3. Zhu et al. (2026) demonstrate directly that frequency cannot separate autonomous from dependent offloading. If preparatory and substitutive use exert opposite effects, aggregating them will attenuate both.

Third, the designs are predominantly cross-sectional and rely on self-report, and self-reported adaptation is likely to correlate with reduced experienced difficulty — the mechanism under examination rather than independent evidence about its consequences. The open question raised by Qu and Chen (2026) is precisely whether simulated interaction subsequently increases or replaces engagement with people, which their design cannot resolve.

The framework is therefore advanced as a set of competing hypotheses to be tested against this emerging evidence, not as a refutation of it. Section 8 specifies the measurement and design features such a test requires.

5. The Friction Paradox

5.1 Defining intercultural friction

This paper defines intercultural friction as a discrepancy between a student's existing expectations, capabilities or interpretive frames and the demands of an unfamiliar context, requiring effortful communication, adaptation, sense-making or action.

Friction is not synonymous with suffering. It may be minor, such as uncertainty about how to enter a seminar discussion, or significant, such as navigating an unfamiliar healthcare system. Its educational value depends on the source of the difficulty, its intensity, the student's available capabilities, the presence of safety and support, whether the student remains engaged, and whether reflection and revised action follow.

The friction paradox arises because generative AI can simultaneously make education abroad more inclusive and weaken one of its principal learning mechanisms. The same technology can remove an exclusionary language barrier in one context and eliminate a valuable communicative encounter in another. Figure 1 sets out the resulting model.

5.2 Two dimensions: educational function and technological origin

The framework distinguishes three forms of friction, but these are not three positions on a single scale, and the distinction between them should be stated precisely to avoid category error.

Harmful friction and productive friction classify difficulty by educational function: whether it excludes the student from participation or creates conditions in which learning may occur. Synthetic friction classifies difficulty by technological origin: it is difficulty generated or intensified by the AI system itself rather than by the host environment.

These are therefore intersecting dimensions rather than mutually exclusive categories. Synthetic friction is not a third educational function; it is friction with a distinctive source, and its educational function remains open. An AI-generated misinterpretation that a student accepts uncritically operates as harmful friction, producing misunderstanding and possibly offence. The same misinterpretation, if the student notices the discrepancy, raises it with a host participant and revises an assumption, may operate as productive friction — indeed as an unusually vivid instance of it, because the student has learned something about the limits of mediated cultural knowledge. Equally, environmental friction may contain

harmful and productive elements simultaneously: a language barrier can both exclude a student from medical care and, in a low-stakes social setting, occasion valuable negotiation of meaning.

The pedagogical implication follows directly. Synthetic friction should be made visible and contestable rather than simply eliminated, because its educational function depends on whether it is detected and examined. Table 1 summarises the taxonomy on this basis.

This requirement connects to a wider concern about epistemic agency under AI mediation. Pietarinen and Shi (2026) argue that generative systems in education can manipulate and deceive in ways that erode critical thinking and creativity, and that preserving epistemic agency requires that machine-supplied claims remain open to challenge. Their analysis addresses education generally and the integrity of the learner's reasoning. The present paper takes up the same concern in a narrower and more relational setting, asking how mediation alters the educational function of difficulty during cross-border mobility, where the claim at issue is typically an interpretation of another person's conduct and the means of contesting it is a further human encounter rather than an argument evaluated alone.

Table 1
A taxonomy of friction in AI-mediated education abroad. Harmful and productive friction describe educational function; synthetic friction describes technological origin and may itself operate as harmful or productive depending on whether it is detected, challenged and reflected upon.

Form	Dimension	Definition	Examples	Appropriate AI role
Harmful	Function	A barrier restricting safety, access or participation without proportionate educational value	Inaccessible emergency information; inability to communicate a medical condition; opaque administrative procedures; disability-related exclusion	Reduce or remove the barrier
Productive	Function	A manageable difficulty that can stimulate engagement, reflection, capability development or perspective revision	Attempting a host-language interaction; asking for help; negotiating disagreement; recognising a mistaken assumption	Prepare, scaffold and support reflection without completing the encounter
Synthetic	Origin	Difficulty created or intensified by AI inaccuracy, cultural reduction, false confidence or inappropriate substitution	Incorrect translation; fabricated local rule; stereotyped cultural explanation; culturally inappropriate drafted response	Expose uncertainty, enable verification, provide human escalation; treat detection itself as a learning opportunity

This taxonomy rejects two simplistic positions. The first is friction romanticism, in which difficulty is presumed to build resilience and students are denied support in the name of immersion; harmful friction can exclude students from the very experiences the programme promises. The second is friction elimination, in which every moment of uncertainty is treated as an inefficiency; this may improve

immediate satisfaction while reducing practice in communication, tolerance for ambiguity and independent judgement.

5.3 The mediation gradient: interpretive agency transferred

The educationally decisive variable is not the type of task AI performs but the degree of interpretive agency transferred to it. This is the distinction Zhu et al. (2026) draw between autonomous and dependent offloading, applied here to relational and intercultural encounters. It matters because task type is a poor proxy: a lengthy AI-drafted message that the student interrogates and rewrites may transfer less agency than a brief cultural explanation accepted without examination.

Five levels can be distinguished:

Access. AI makes an otherwise impossible task possible — captioning a lecture, translating essential safety information, defining unfamiliar terminology. The student retains full interpretive responsibility.

Preparation. AI supports the student before action — rehearsing a conversation, identifying vocabulary, generating questions, or simulating an interlocutor as in Qu and Chen (2026). Agency remains with the student, and the encounter still occurs.

Co-interpretation. AI supplies hypotheses that the student evaluates — offering several possible readings of a behaviour and the evidence that would distinguish them. Agency is shared, and learning depends on whether the student actually adjudicates.

Delegation. AI performs the interpretive or communicative work while the student retains formal approval — composing a response the student sends with minimal revision, or supplying a single explanation the student adopts.

Substitution. AI displaces the human encounter or the reflective process entirely — sustaining a relationship in place of human contact, or generating the student's reflection.

The level is diagnosed not by the tool used but by five questions: who frames the question; who evaluates competing meanings; who chooses the response; whether a human encounter follows; and whether the student reflects afterwards. Timing interacts with this gradient. The same output used anticipatorily may function as preparation, used in real time may function as delegation, and used retrospectively may function as co-interpretation — an explanation supplied before an encounter can become the stereotype through which the student sees it, whereas the same explanation considered afterwards, as one hypothesis among several, may stimulate reflection.

Access and preparation generally preserve agency. Co-interpretation is educationally productive when the student adjudicates and closes prematurely when the student does not. Delegation and substitution may be justified for harmful friction but are most likely to erode learning when applied to productive friction.

5.4 An immersion heuristic

Because AI support and human engagement vary independently, they can be crossed to produce a practical heuristic for programme designers (Table 2). This is offered as a diagnostic aid rather than as a further theoretical construct.

Table 2
Immersion heuristic: AI support by human engagement.

Low AI support	**Low human engagement**	**High human engagement**
	Unmanaged struggle: difficulty without adequate technological or relational support; friction becomes exclusion, isolation or withdrawal.	**Traditional immersion: direct engagement with people and contexts, but accessibility depends heavily on individual resources and programme quality.**
High AI support	Frictionless enclosure: AI translates, interprets, reassures and solves problems while host-community interaction remains limited.	Supported immersion: AI removes harmful barriers, prepares students for interaction and strengthens reflection while human relationships remain central.

The target condition is supported immersion, not minimal technology. The heuristic also clarifies why volume of AI use is theoretically weak as a measure: two students may use AI equally often, one to prepare for and reflect on daily host-community interactions, the other to avoid them.

5.5 The friction-conversion principle

The paper proposes the following principle: responsible AI in education abroad should reduce harmful friction, convert manageable difficulty into supported participation, preserve the student's interpretive role in productive encounters, and make synthetic friction visible and contestable.

Friction conversion differs from friction removal. The objective is to change the conditions under which difficulty is encountered. Instead of writing the student's complaint to a landlord, AI helps identify the issue, explains possible tones, teaches relevant phrases and asks the student to select and personalise the message. Instead of declaring why a host student behaved in a particular way, AI generates multiple hypotheses and recommends a respectful question. Instead of replacing a language interaction with automatic translation, AI supports vocabulary preparation and post-interaction review. Instead of providing emotional reassurance indefinitely, AI encourages contact with peers, mentors or appropriate support services. The principle places educational purpose before technological efficiency.

6. Propositions

The framework generates five propositions, stated so that the argument can be tested, qualified or refuted.

Proposition 1

(Interpretive agency, not volume). Intercultural learning will be associated with the degree of interpretive agency retained by the student rather than with the frequency of AI use. When it enables a human encounter that would otherwise not occur, access and preparatory AI use will be associated with equal or greater intercultural learning than non-use; delegation and substitution during culturally ambiguous encounters will be associated with lower host-community engagement and weaker learning.

Proposition 2

(Interpretive offloading). The relationship between substitutive AI use and intercultural learning will be mediated by interpretive offloading and reduced reflective processing. Students who consistently obtain immediate cultural explanations will be less likely to hold competing interpretations open, seek contextual evidence or recognise the situated nature of their own perspective.

Proposition 3

(Conditional capability expansion). AI support will produce its strongest positive effects among students facing substantial linguistic, disability-related or psychological barriers, provided that tool access, AI literacy and appropriate human escalation are available. Where those conditions are absent, the same students may be most exposed to synthetic friction, because capacity to verify output is lowest precisely where reliance is highest.

Proposition 4

(Cultural mentorship). Cultural mentorship will moderate the effects of AI mediation: guided use will be more likely to convert disorientation into learning, whereas unguided use will be more likely to produce avoidance, overconfidence or culturally reductive interpretation. This extends the guided-disorientation argument of Gibson et al. (2023); mentors need not answer every question, but help students evaluate when AI should be trusted, questioned or set aside.

Proposition 5

(Convenience–learning divergence). Student satisfaction and sociocultural adaptation may increase under AI mediation even where intercultural engagement and frame revision decrease. Convenience, adaptation and intercultural learning should therefore be measured separately. This proposition specifies the condition under which the present framework and the adaptation findings discussed in Section 4.6 would yield different conclusions from the same data.

Two further expectations follow from the taxonomy rather than standing as independent propositions. Synthetic friction is expected to concentrate in culturally ambiguous, emotionally charged and high-stakes situations where students have limited local knowledge and limited capacity to verify output; and retrospective AI use is expected to support learning where students compare, verify and revise AI-generated interpretations, but not where the system supplies the final reflection without student evaluation.

7. Implications for Education-Abroad Practice

7.1 Teach mediation literacy, not only AI literacy

Generic AI literacy covers prompting, hallucination, privacy, bias and academic integrity. Education-abroad students need a further capability: recognising what part of an encounter AI is performing, whether the task is administrative or educational, how much interpretive agency is being transferred, when local or human knowledge is necessary, and whether use is increasing or decreasing contact with people. Pre-departure orientation should ask students to classify realistic scenarios by friction type and mediation level. The purpose is not rigid rules but judgement. Mentorship remains central to this, and the availability of AI changes rather than reduces what mentors must address: AI-generated cultural interpretations, overconfident translation, stereotypes presented as neutral explanation, signs that a student is using AI to avoid interaction, and the difference between emotional support and relational substitution. Students may not recognise synthetic friction on their own, because an incorrect answer delivered fluently feels like the resolution of confusion rather than a new source of it.

7.2 Design AI to prepare rather than perform

Programme guidance should distinguish uses that help students enter an encounter from uses that allow them to avoid it. A prepare-participate-reflect sequence is preferable: use AI to identify vocabulary, possible questions and areas of uncertainty; engage directly with the relevant person or setting wherever reasonably possible; then compare expectations, the actual encounter and the system's earlier assumptions. Evidence that simulated interlocutors reduce speaking anxiety and increase communicative risk-taking (Qu and Chen 2026) suggests preparation may be especially valuable for students who would otherwise not participate, provided the simulation leads to a human encounter rather than replacing one. A brief mediation log supports the same end: recording the situation, why AI was used, what role it performed, whether a human interaction followed, and what was accepted or questioned. Its purpose is metacognitive, making invisible mediation visible, and it should not become surveillance or a tally of prohibited uses. Whether educators can carry this guidance depends on their own confidence with the systems: reviews of educator trust in generative AI find it uneven and strongly shaped by institutional support (Lelescu et al. 2025), so mediation literacy is a staff-development question as much as a student-facing one.

7.3 Redesign assessment and escalation

Assessment should not reward polished accounts of transformation that AI can readily generate. It should examine the interpretive process: comparison of initial and revised interpretations, analysis of an AI-generated cultural explanation, evidence gathered through direct interaction, identification of unresolved ambiguity, and oral discussion with a faculty member or cultural mentor. Students should be permitted to use AI in ways aligned with the learning objective but should disclose how mediation occurred. Separately, AI should not be treated as authoritative for visa or immigration compliance, medical emergencies, personal safety, discrimination or harassment reporting, legal obligations,

disciplinary matters or acute psychological distress, and programmes should publish human escalation routes. The issue is not that such systems will always be wrong, but that the cost of undetected error is high and the system bears no responsibility for the consequences.

7.4 Evaluate interaction, not only satisfaction

Programme evaluation should record whether AI use changed the frequency and quality of host-community interaction, willingness to communicate under uncertainty, tolerance for ambiguity, reflective judgement, independent problem-solving, sense of belonging, and dependence on home-country and AI-mediated networks. Satisfaction remains relevant, particularly where poor support produces harmful friction, but it should not become the principal measure of educational success, since the friction paradox predicts precisely that satisfaction and learning can move in opposite directions.

8. Research Agenda

The framework requires empirical testing across forms of mobility that differ in autonomy, exposure, duration and institutional support, and, as Section 2.3 notes, in whether intercultural development is a stated objective at all.

8.1 Measurement and design

Research should distinguish AI-use frequency from function, the level of interpretive agency transferred, the timing of use, whether human interaction followed, and whether output was verified. Zhu et al. (2026) offer a directly transferable starting point in their separation of autonomous from dependent offloading; the extension required here is from academic cognition to relational encounters. Such instrumentation is a precondition for adjudicating between this framework and the adaptation findings in Section 4.6, which aggregate across exactly these distinctions. Outcomes should likewise separate psychological adjustment, sociocultural adaptation, academic adaptation and intercultural competence (Deardorff 2006; Searle and Ward 1990). Because cross-sectional designs cannot establish whether AI dependence precedes disengagement or follows from it, longitudinal work should examine use before departure, during initial adjustment, after several months abroad and following return, with experience-sampling capturing encounters close to when they occur. Programme-level comparisons of unrestricted use, generic AI-literacy training, mediation-literacy training, and mediation literacy combined with cultural mentorship would test the framework directly, and the most informative single test follows from Qu and Chen (2026): whether simulated intercultural interaction increases or replaces subsequent engagement with people. Outcomes should include behaviour as well as self-report.

8.2 Equity and host-community perspectives

Research must establish who benefits from friction and who is excluded by it, since the same language challenge may be stimulating for one student and disabling for another. Studies should consider disability, socioeconomic background, prior travel, race, language, anxiety, gender, AI literacy and access to human support, and should test Proposition 3 directly, because the students most helped by AI may

also be least able to verify its output. The objective is not to restore a nostalgic immersion designed around the most confident student, but to create supported immersion in which more students participate without an entirely frictionless experience. Finally, most education-abroad research privileges the mobile student. AI mediation also reshapes the position of host families, faculty, domestic students, employers and community partners, who may find interactions less reciprocal, may be misrepresented when a system generalises about their culture, and rarely have standing to contest an AI-generated interpretation of their own conduct.

9. Discussion

Generative AI exposes an unresolved assumption within education abroad: that obstacles should either be celebrated as immersion or removed as inefficiencies. Neither position is adequate.

Distinguishing harmful and productive friction by function, and synthetic friction by origin, provides a more defensible basis for programme decisions. Harmful friction is inequitable and should be reduced. Productive friction should not be maximised indiscriminately but preserved in a form students can engage with safely and reflectively. Synthetic friction requires scrutiny rather than elimination, because whether it harms or teaches depends on whether it is detected.

The mediation gradient shows why debates framed around whether AI is permitted are unlikely to be useful. Institutional responses to generative AI have so far concentrated on exactly that question — early university policies cluster around permission and prohibition (Dabis and Csáki 2024), and students themselves frame the choice as adoption versus ban (Farinosi and Melchior 2025) — while the variable that carries the educational consequences goes unmeasured. What matters is how much interpretive agency is transferred and whether a human encounter follows — a distinction that volume of use cannot capture, as Zhu et al. (2026) demonstrate for academic cognition.

The paper's principal theoretical claim is that generative AI alters not only how students solve problems abroad but where intercultural interpretation occurs. Interpretation may move from the student's encounter with another person, through reflection and dialogue, into an opaque system that supplies an immediate account of what the encounter supposedly means. This is a relocation of educational authority.

That relocation is not necessarily harmful. Drewelow (2026) and Qu and Chen (2026) show that AI can widen perspective and enable communicative risk-taking that anxiety would otherwise prevent. It becomes educationally problematic when it converts ambiguity into certainty and participation into consumption.

Two limitations should be stated plainly. First, the framework is conceptual: it organises existing evidence and reasoning but has not itself been tested, and the propositions in Section 6 may not survive examination. Second, the available empirical literature reports positive associations between AI use and international-student adaptation, and in one case with intercultural communicative competence itself

(Kadriu and Jemini Gashi 2026; Ma et al. 2025; Qu and Chen 2026; Zhu and Yang 2026). The present argument does not contradict those findings. It questions whether adaptation is the outcome by which education abroad should principally be judged, and predicts divergence between adaptation and intercultural learning under substitutive mediation. That prediction is falsifiable, and Section 8 specifies designs capable of falsifying it.

The supported-immersion condition therefore treats AI and human engagement as complementary. Technology should expand a student's capacity to enter the host environment, not construct a seamless layer through which that environment is experienced at a distance.

10. Conclusion

Education abroad is not transformative because students cross a border. It becomes transformative when unfamiliar encounters are converted into reflection, revised understanding and more capable participation.

Generative AI can widen access to those encounters. It can also make them unnecessary.

The friction paradox captures this double effect. Responsible programme design should neither preserve difficulty for its own sake nor pursue frictionless mobility as an unquestioned good. It should remove barriers that exclude, scaffold challenges that develop, and make visible the new difficulties AI itself introduces. The educational effect of AI abroad depends on which friction it removes, how much interpretive agency it assumes, and whether its mediation returns the student to human engagement or replaces it.

The future of education abroad will not be technologically unmediated. The relevant question is whether mediation returns students to human relationships and unfamiliar contexts with greater capacity, or allows them to remain abroad without meaningfully encountering either.

Use of generative artificial intelligence

Generative AI tools (Claude) were used for citation verification.

Declarations

Competing Interests

The author is the proprietor of Karan Gupta Consulting, Mumbai, India, which provides education and career counselling including advising on education abroad, and therefore has a professional interest in the field discussed. The author also serves as Managing Director, India and South Asia, at IE University. No participating organisation, student or dataset is involved in this conceptual article.

Ethical approval

Not applicable. This article is a conceptual analysis and does not involve human participants, human data or human tissue.

Informed consent

Not applicable. This article does not involve human participants.

Author Contribution

K.G. conceived the study, developed the conceptual framework, taxonomy, mediation gradient and propositions, prepared Fig. 1 and Tables 1–2, and wrote and reviewed the manuscript.

Data availability

No datasets were generated or analysed for this conceptual article. All sources discussed are cited in the reference list.

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Figures

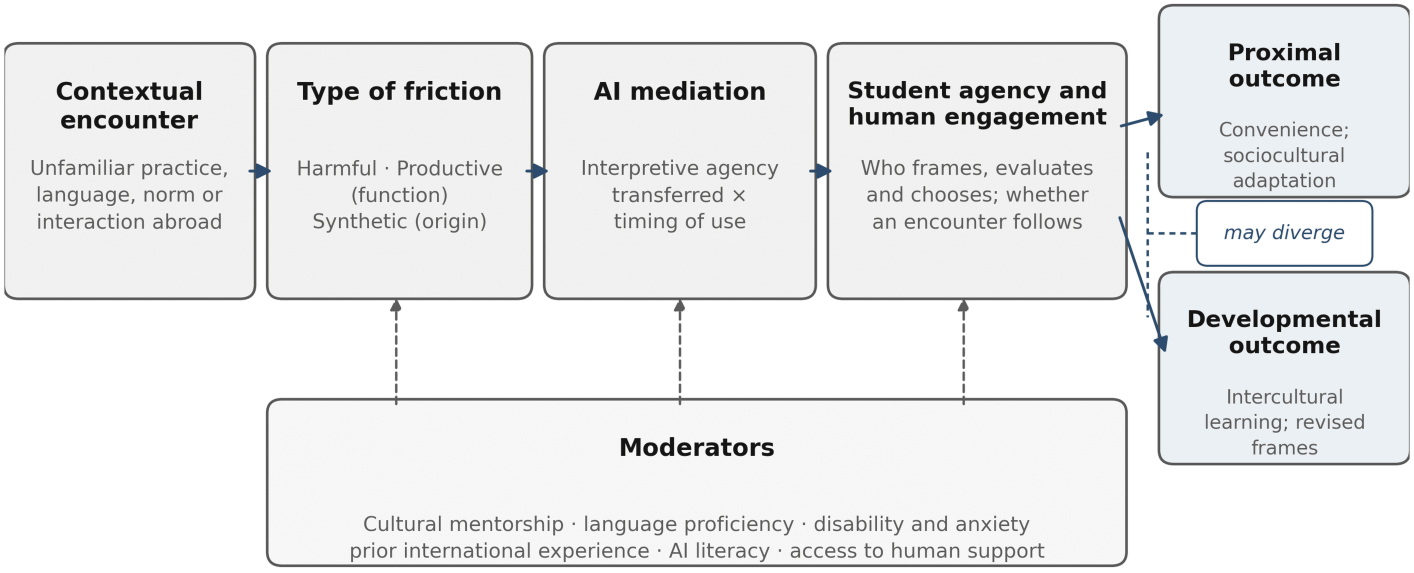


Figure 1

The friction-mediation model of AI in education abroad

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