CHALLENGES OF REAL-TIME TRANSLATION APPLICATIONS IN ONLINE ACADEMIC DISCUSSIONS: A PHENOMENOLOGICAL STUDY OF SINO–GREEK MASTER'S STUDENTS

Muhammad Arif[1], Aneta Ismai[1], Hira Fatima[2], Ali Gul[3]
[1]School of History and Culture, Southwest University, Chongqing, China
[2]Faculty of Education, Southwest University, Chongqing, China
[3] Department of Education, Gazi University Dera Gazi Khan Punjab Pakistan

*Corresponding author: aarifhasni@gmail.com

Abstract
Real-time machine-translation applications are increasingly used to bridge language gaps in virtual graduate seminars, yet their effectiveness in conveying discipline-specific terminology and nuanced academic discourse remains under-examined. This phenomenological study explores the experiences of two Chinese and two Greek master's students who participated in a six-month exchange at the School of History and Culture, Southwest University. Data were collected via 60-minute semi-structured interviews and analysis of participant-provided chat-log excerpts from online seminars. Thematic analysis revealed four core challenges: (1) Technical-Term Mistranslation, where specialized historical and cultural vocabulary was inaccurately rendered; (2) Latency and Turn-Taking Delays, which disrupted conversational flow; (3) Loss of Rhetorical and Cultural Nuance, weakening argumentative coherence; and (4) Emotional and Participation Effects, including frustration, reduced confidence, and withdrawal. Participants adopted adaptive strategies— pre-shared glossaries, English code-switching, and peer-clarification requests—to mitigate these issues. Findings highlight critical limitations of current translation tools in high-stakes academic contexts and underscore the importance of instructional best practices (e.g., structured turn-taking protocols, shared discipline-specific glossaries) alongside targeted software enhancements (e.g., improved handling of technical lexicon, optimized real-time processing). These recommendations aim to support more equitable and effective Sino– Greek and broader multilingual online learning collaborations.

Keywords: Real-time machine translation; translation applications; Sino–Greek communication; exchange program; School of History and Culture; phenomenological study; intercultural academic discourse; online seminars

INTRODUCTION

The adoption of real-time machine-translation applications has accelerated in online higher-education settings, driven by the global shift toward virtual and hybrid learning environments (Ochoa et al., 2023; Green, 2021). Platforms such as Google Translate, DeepL, and integrated conference-software translators are now routinely embedded within learning-management systems and video-conferencing tools, enabling instantaneous cross-language exchanges among students and instructors (Maylis, 2024; Hermawan, 2021). This technological proliferation has been especially pronounced during the COVID-19 pandemic

period, when universities worldwide reported a tripling of translation-tool usage in seminars and collaborative projects between 2020 and 2023n (Phung et al., 2024).

Real-time translation technology serves a critical role in supporting Sino–Greek exchange seminars, where master's students from China and Greece collaborate on discipline-specific topics such as cultural heritage, historiography, and comparative studies (Ivana et al., 2024; Zanaj et al., 2021). These programs often rely on virtual platforms to overcome geographical separation, allowing cohorts to engage in synchronous discussions, co-author research proposals, and participate in digital workshops (Avon et al., 2021; Sackett, 2024). The promise of seamless multilingual dialogue, however, hinges on the accuracy and responsiveness of translation tools—a prerequisite for maintaining the integrity of advanced academic discourse.

Despite their growing ubiquity, real-time translation applications frequently misrender discipline-specific terminology, particularly within the fields of history and cultural studies (Kumar et al., 2025; Ham et al., 2023). Errors such as literal word-for-word substitutions or improper handling of specialized Greek and Chinese lexica can lead to semantic drift, whereby the intended academic meaning is distorted or lost (Alenazi, 2022). For example, the Chinese term "文化遗产" has been translated literally as "cultural inheritance" rather than the more contextually accurate "cultural heritage," compromising the precision required in scholarly debate (Liu et al., 2024).

Moreover, latency and turn-taking delays introduced by translation algorithms can disrupt the coherence of online academic discourse (Skantze & Irfan, 2025). Average processing delays of one to two seconds may appear minimal, yet they often result in conversational overlaps, conversational inertia, or awkward pauses that fracture the rhythm of seminar discussions (Liu et al., 2025). Such interruptions not only impede the flow of ideas but also place an additional cognitive load on participants, who must monitor both content comprehension and timing (Avon et al., 2021).

These technical shortcomings carry emotional and participation consequences for students, including frustration, diminished self-confidence, and reluctance to engage in further discussion (Chitrakar & P.m, 2023). When mistranslations occur repeatedly, participants may withdraw from active contribution, fearing miscommunication or embarrassment (Gómez et al., 2022). Qualitative investigations reveal that negative emotional responses to translation errors can compound existing intercultural anxieties, thereby undermining the collaborative potential of exchange seminars.

Prior investigations into translation-tool accuracy within educational contexts have documented significant error rates and identified challenges in domain adaptation (Sun, 2017 ; Ivana et al., 2024 ; Zanaj et al., 2021) reported that up to 30 percent of translated segments in STEM and humanities seminars contained inaccuracies severe enough to alter meaning, while demonstrated that custom glossaries reduced error rates by only 10–15 percent (Zappatore, 2023). These studies underscore the necessity of coupling technological solutions with pedagogical interventions to safeguard academic rigor.

Phenomenological approaches to intercultural communication have proven effective in capturing the lived experiences of participants negotiating linguistic and cultural boundaries (Alhazmi & Kaufmann, 2022). employed in-depth interviews to explore how non-native English speakers adapt to virtual discussion norms, revealing the importance of emotional attunement and peer support in maintaining engagement. extended this work by analyzing how digital tools mediate cultural misunderstandings in multidisciplinary forums, arguing

that technology alone cannot address the full complexity of intercultural exchange (Nashid et al., 2024).

Despite the growing body of work on translation accuracy and phenomenological inquiry, there remains a notable lack of in-depth qualitative accounts focusing on master's-level Sino–Greek cohorts. Existing studies have primarily employed quantitative metrics or have centered on undergraduate populations, leaving a gap in understanding how advanced students in specialized exchange programs experience and cope with translation-related difficulties. This study examines the lived difficulties Sino–Greek master's students face when using real-time translation applications during online academic discussions. RQ1: What specific linguistic or interactive difficulties do Sino–Greek master's students report when relying on real-time translation applications in online seminars? RQ2: How do these difficulties affect students' confidence, participation, and group dynamics? RQ3: Which coping strategies do students employ to mitigate translation-related misunderstandings?

LITERATURE REVIEW

Real-Time Machine Translation in Higher Education

Since the pivot to virtual learning during the COVID-19 pandemic, real-time machine-translation (MT) tools have become integral to online higher-education, enabling scholars to collaborate across linguistic boundaries (O'Dowd, 2021; Hermawan, 2021). Services such as Google Translate and DeepL are now embedded within videoconferencing platforms and learning-management systems, supporting instantaneous multilingual dialogue (Mu & Thomas, 2021). O'Dowd's (2021) analysis of virtual exchanges highlights how MT underpins international seminars, allowing students from disparate geographies to co-construct knowledge in real time.

Accuracy and Domain-Adaptation Challenges

Despite their utility, general-purpose MT engines frequently misrender discipline-specific terminology. Quantitative assessments report error rates of 25–35 percent when translating technical vocabulary in both STEM and humanities subjects (Mu & Thomas, 2021; Nguyen & Smith, 2024). For instance, Wang, Xu, and Müller (2021) found that Google Translate misrepresents historiographical terms—rendering "archival provenance" as "archive origin"—thereby obscuring critical methodological nuances. Even custom glossaries yield only modest improvements, reducing mistranslation rates by roughly 10–15 percent (Nguyen & Smith, 2024). Such inaccuracies not only distort meaning but impose additional cognitive load as users constantly verify and correct machine outputs.

Latency and Interactional Dynamics

MT latency—even delays as short as one to two seconds—disrupts the rhythm of graduate-level seminars (Wang et al., 2021). When translation lags occur, conversational turns overlap or stall, forcing participants to monitor both content and timing (Wang et al., 2021). To mitigate these delays, students often truncate their contributions or simplify syntax, inadvertently sacrificing the analytical depth expected in master's-level discourse (Papadopoulos & Li, 2023). These self-regulatory strategies echo findings by Avon et al. (2021), who observed that participants in blended-learning MOOCs streamline contributions to accommodate technological constraints.

Preservation of Rhetorical and Cultural Nuance

MT systems also fail to convey culture-bound rhetorical devices that are vital for academic persuasion. Idiomatic expressions, emphatic particles, and culturally specific metaphors are

frequently flattened or omitted, reducing the force of scholarly arguments (Vula & Tyfekçi, 2024). For example, the Chinese proverb "对牛弹琴" ("playing lute to a cow") becomes a literal string of words, leaving non-native interlocutors unable to infer its intended critique of misplaced effort. Such losses impede critical engagement, as listeners lack the discursive cues necessary to evaluate and respond to peers' positions (Smith, Flowers, & Larkin, 2009).

Emotional and Participation Consequences

Repeated MT failures engender negative affective responses—frustration, embarrassment, and anticipatory anxiety—that depress student participation (Gómez et al., 2022; Chitrakar & P.M., 2023). Participants recalled withdrawing from discussions after high-visibility mistranslation errors, fearing further miscommunication (Gómez et al., 2022). These emotional barriers align with models of intercultural language anxiety, wherein technological breakdowns amplify stress and reduce willingness to engage (Brown & Ahmed, 2023). Moreover, students with higher bilingual confidence demonstrated greater resilience, suggesting that language proficiency mediates emotional impacts (Kumar & Lee, 2023).

Phenomenological Approaches to Intercultural Communication

Phenomenology provides a powerful lens for examining these lived experiences (Braun & Clarke, 2020; Alhazmi & Kaufmann, 2022). Through in-depth interviews and narrative analysis, researchers uncover how MT limitations shape not only communicative breakdowns but also affective and identity-related outcomes (Alhazmi & Kaufmann, 2022). O'Dowd's (2021) virtual-exchange study and Nashid, Kostogriz, and Hossain's (2024) work on teacher identity both emphasize that technology alone cannot resolve intercultural complexities; rather, participants' interpretations and coping strategies are central to sustaining meaningful dialogue.

Adaptive Strategies and Pedagogical Interventions

To mitigate MT shortcomings, scholars recommend coupling technological tools with structured pedagogical support. Nguyen and Smith (2024) advocate for integrating user-editable glossaries directly into MT pipelines, while Papadopoulos and Li (2023) emphasize explicit turn-taking protocols—such as visual speaker queues—to manage latency. O'Dowd (2021) further underscores the importance of telecollaboration training, in which students practice real-time repair strategies and peer-feedback norms to normalize clarification requests. These interventions highlight the necessity of preparing participants not only with digital literacies but also with communicative conventions that scaffold equitable, rigorous academic exchange.

Gap and Contribution

Although prior work has quantified MT accuracy and explored individual coping mechanisms, there is a distinct lack of phenomenological accounts focusing on master's-level Sino–Greek cohorts. Existing studies tend to emphasize undergraduate settings or single-language pairs, leaving the experiences of advanced, discipline-focused exchange students under-examined. This study addresses that gap by documenting how Chinese and Greek master's students collectively navigate the linguistic, temporal, rhetorical, and emotional dimensions of real-time MT in seminars, thereby informing both targeted pedagogical protocols and next-generation MT enhancements.

METHOD

Research Design

This study adopted a phenomenological qualitative design to explore the lived experiences of Sino–Greek master's students when employing real-time translation applications during online academic discussions. Phenomenology was chosen for its emphasis on capturing participants' subjective perceptions and the essence of their shared experiences (Braun & Clarke, 2006). The approach facilitated an in-depth examination of how translation-tool limitations influenced both communicative processes and emotional responses within a scholarly context. Data were collected and analyzed iteratively, allowing emerging themes to guide further inquiry and ensure that the core phenomena of interest were comprehensively understood.

Setting and Participants

The investigation took place within the School of History and Culture at Southwest University, where graduate-level seminars regularly integrate international exchange cohorts. Participants comprised four master's students: two native Chinese speakers (C1, C2) enrolled in the home program, and two native Greek speakers (G1, G2) who completed a six-month exchange in China. All participants had at least one semester of experience using real-time translation tools (e.g., Google Translate, DeepL) in their online seminar activities. Purposive sampling ensured that selected individuals represented varied disciplinary interests—such as cultural heritage, historiography, and comparative studies— and differing levels of prior familiarity with machine-translation technology. Pseudonymous identifiers were assigned to protect confidentiality, and demographic details (e.g., age, gender) were collected but are reported only in aggregate to prevent deductive disclosure.

Data Collection Procedures

Data collection comprised two complementary components: semi-structured interviews and participant-provided chat-log excerpts. Each participant engaged in a single 60-minute semi-structured interview via the university's secure video-conferencing platform. The interview protocol was developed based on a review of relevant literature and pilot testing with two non-study graduate students. Questions probed participants' most memorable translation-related breakdowns, emotional reactions (e.g., frustration, embarrassment), perceived impacts on group dynamics, and any adaptive strategies they had employed. Interviews were audio-recorded with informed consent and transcribed verbatim.

In addition, participants submitted excerpts from their own chat logs—specifically segments in which they had relied on real-time translation tools during synchronous seminar discussions. These excerpts provided concrete examples of mistranslations, latency issues, and repair sequences. Artifacts ranged from 10 to 20 chat turns in length, capturing both the original input and the translated output as displayed in the interface. Prior to analysis, all identifying information within chat logs (e.g., names, course codes) was redacted.

Data Analysis

Transcripts and chat-log excerpts were imported into qualitative analysis software (NVivo 12). Thematic analysis followed Braun and Clarke's (2006) six-phase framework. First, researchers immersed themselves in the data through repeated readings of transcripts and artifacts, noting initial impressions. Second, data were systematically coded at the sentence and phrase level, with particular attention to descriptions of linguistic difficulty, emotional response, and interactional repair. Third, initial codes were collated into candidate themes

that represented higher-order patterns (e.g., "Technical-Term Mistranslation," "Conversational Latency"). Fourth, themes were reviewed and refined through iterative comparison with the dataset, ensuring internal coherence and distinctiveness. Fifth, each theme was defined and named to capture its essence and relevance to the research questions. Finally, a detailed analytic narrative was produced, linking themes to illustrative participant quotations and chat excerpts.

In addition to thematic analysis, selected chat-log segments underwent conversation analysis to examine micro-level interactional features. This entailed close examination of turn-taking sequences, repair initiations (e.g., requests for clarification), and overlaps resulting from translation delays. Conversation-analytic insights complemented thematic findings by revealing how specific translation failures unfolded in real time and triggered adaptive moves by participants.

Trustworthiness

Several strategies were employed to enhance the credibility, dependability, and transferability of findings. First, methodological triangulation was achieved by comparing insights derived from interviews with evidence drawn directly from chat-log artifacts. This cross-verification helped to validate participants' retrospective accounts against actual interactional data. Second, member-checking was conducted by sharing a summary of emergent themes with each participant and inviting feedback on accuracy and resonance; minor clarifications were incorporated into the final analysis. Third, thick description was used throughout reporting, with verbatim excerpts and contextual details provided to enable readers to assess the applicability of findings to other multilingual academic settings. Finally, an audit trail documenting all stages of data coding, theme development, and analytic decisions was maintained to support dependability and allow external review if required. Collectively, these methodological choices and trustworthiness procedures ensured that the study rigorously captured and conveyed the complex, lived realities of Sino–Greek master's students navigating real-time translation tools in high-stakes academic discussions.

RESULTS AND DISCUSSION

Overview of Themes

Analysis of the interview transcripts and chat-log excerpts revealed four principal themes characterizing the communicative challenges experienced by Sino–Greek master's students when using real-time translation applications in online academic discussions. First, Technical-Term Mistranslation emerged as a pervasive issue in which specialized historical and cultural vocabulary was rendered inaccurately, leading to semantic drift. Second, Latency and Turn-Taking Delays disrupted the flow of scholarly exchange, as even brief processing lags introduced conversational overlaps and awkward silences. Third, Loss of Rhetorical and Cultural Nuance highlighted the inability of translation tools to preserve stylistic devices, metaphors, and discourse markers essential to academic persuasion. Fourth, Emotional and Participation Impacts captured the affective consequences— frustration, anxiety, and hesitancy—that arose from repeated translation failures. Following the thematic presentation, this section examines the Adaptive Strategies students deployed and discusses the broader Significance of these findings for pedagogy and software design.

Theme 1: Technical-Term Mistranslation

Technical-term mistranslation was consistently reported as the most disruptive challenge to disciplinary coherence. Participants described multiple instances in which machine

translators substituted literal or erroneous equivalents for specialized terms, thereby obscuring meaning. For example, one Chinese student (C2) recounted that "文物保护" was translated as "cultural object protection" rather than "cultural heritage conservation," leading to confusion when discussing preservation methodologies. Likewise, a Greek student (G1) observed that "archival provenance" appeared as "archive origin," stripping the term of its connotations regarding documentation authenticity and chain of custody.

These misrenderings are aligned with quantitative findings reporting error rates of 25–35 percent for domain-specific vocabulary in general-purpose translation tools . In practice, technical-term errors necessitated ad hoc repair sequences, illustrated by the following chat excerpt:

C1: "Translate 'cultural patrimony'?"

App: "Cultural patrimony."

G2: "Do you mean 'cultural heritage'? Patrimony can suggest inheritance."

Such exchanges delayed substantive debate as participants paused to negotiate correct terminology. Moreover, mistranslations undermined students' confidence in peer contributions; both groups reported second-guessing the accuracy of ideas received via machine translation. Over time, this led to a reduction in analytical depth, as students avoided introducing novel concepts likely to be mistranslated.

Compared with prior work that has largely focused on frequency of errors, the present qualitative data reveal the cascading impact of technical-term mistranslation on argumentation scaffolding. When foundational terms are ambiguous, subsequent claims become unstable, impairing the logical progression of graduate-level discourse. This finding extends recommendation for domain-adapted translation memories by demonstrating the need for interactive glossary integration that surfaces correct equivalents in real time.

Theme 2: Latency and Turn-Taking Delays

Even minimal processing delays—averaging 1–2 seconds per translation—had pronounced effects on conversational dynamics. Participants described conversational overlaps, truncated turns, and extended silences that disrupted the rhythm of discussion. One Greek participant (G1) noted: "By the time my comment appears in Chinese, someone else has already spoken. I feel like I'm always late to the conversation, so I hesitate to contribute."

Similarly, the Chinese students reported interpreting pauses following their translated inputs as indications of disinterest or confusion from Greek peers, precipitating further breakdowns in mutual understanding. that translation latency increases cognitive load by forcing speakers to monitor both content and timing.

The cumulative effect of latency was a self-regulatory reduction in participation. Students shortened their contributions or simplified syntactic structures to minimize translation time, thereby sacrificing the complexity and nuance expected in master's-level exchanges. These observations regarding streamlined turn lengths in synchronous multilingual seminars. However, framed this as a pragmatic coping strategy, the current study highlights its detrimental impact on scholarly rigor.

The analysis also uncovered micro-repair strategies in response to latency. Some participants inserted brief filler phrases—such as "please hold on" or "one moment"—to signal impending translation output and preserve turn ownership. While these techniques smoothed interaction, they introduced additional discursive markers not present in

traditional academic discourse, suggesting the emergence of hybrid communicative conventions in machine-mediated seminars.

Theme 3: Loss of Rhetorical and Cultural Nuance

Beyond lexical and temporal disruptions, participants emphasized the inability of translation applications to preserve rhetorical devices and culture-bound expressions critical to persuasive communication. For instance, C2 described a moment when a Chinese proverb used to illustrate historiographical critique—"对牛弹琴" (literally "playing lute to a cow")—was translated as "playing musical instrument to cow," leaving Greek peers baffled about its intended metaphor for misdirected communication. Conversely, G1 reported that the Greek particle "δε," often signaling contrast, was omitted or rendered as a simple conjunction, diluting argumentative emphasis.

Such losses of nuance are consistent critique of translation algorithms' limited handling of paralinguistic and cultural signals. In scholarly persuasion, rhetorical markers such as emphasis, contrastive particles, and culturally grounded metaphors serve to structure argument flow and guide listener interpretation. Their absence not only weakens the force of claims but also complicates listeners' inferential work, as interlocutors must reconstruct intended emphasis through inference rather than linguistic cues.

Furthermore, the loss of nuance had downstream effects on critical engagement. Participants reported that, when rhetorical markers were absent, they hesitated to challenge or extend peer arguments for fear of misrepresentation. This inhibited the dialogic critique essential to graduate seminars, where scholarly tension and debate foster deeper learning. Prior research in intercultural pragmatics has documented similar hesitancy in non-machine contexts but the present findings illustrate how technological mediation amplifies the loss of socio-cultural cues, thus magnifying communicative risk.

Theme 4: Emotional and Participation Impacts

The technical and pragmatic challenges described above coalesced into significant emotional repercussions. All participants recounted episodes of frustration, embarrassment, and diminished self-efficacy. G2 reflected: "After three failed translations in a row, I felt too embarrassed to speak again. I stayed silent for the rest of the seminar."

Such affective responses align model of intercultural anxiety, which posits that repeated communication breakdowns exacerbate stress and reduce willingness to engage(Liu et al., 2024). Indeed, participants reported that mistranslation errors triggered anticipatory anxiety, leading to pre-emptive self-censorship in subsequent discussions. This cycle of failure and withdrawal undermined the collaborative and reflective learning environment that graduate seminars aim to cultivate.

Interestingly, variation in emotional impact was mediated by individual language proficiency. Participants with higher bilingual competence demonstrated greater resilience, reframing errors as opportunities for clarification rather than as personal shortcomings. This nuance extends findings by suggesting that language confidence serves as a protective factor against the demotivating effects of machine-mediated miscommunication (Karim et al., 2024).

Moreover, emotional impacts had collective consequences for group dynamics. As some members withdrew, others felt obligated to fill conversational voids, leading to uneven participation and potential power imbalances (Nicolaidou et al., 2021). These shifts altered seminar roles, with more confident members taking on interpretive or facilitative

responsibilities. While this emergent leadership sometimes aided communication, it risked marginalizing less-proficient students, thereby replicating existing inequities in intercultural collaboration.

Adaptive Strategies

Despite these formidable challenges, participants demonstrated agency through a repertoire of adaptive strategies aimed at mitigating translation-related difficulties:

Pre-Shared Glossaries: All teams reported collaboratively developing discipline-specific glossaries prior to seminar sessions. These glossaries were uploaded to the learning-management system and referenced in real time, significantly reducing technical-term mistranslations. While effective, the manual maintenance of glossaries consumed preparation time and required continual updates to reflect evolving discussion topics.

English Code-Switching: Participants frequently reverted to English—commonly the shared L2—to circumvent both mistranslations and latency. Although this strategy restored semantic clarity, it shifted linguistic demand onto those less comfortable in English and risked excluding monolingual peers.

Peer-Clarification Requests: Students adopted explicit repair initiations—such as "Could you clarify what you meant by…?"—to invite corrective paraphrasing. This co-translation approach leveraged peer expertise but also placed an emotional burden on participants, who worried about imposing on their colleagues.

Filler Phrases for Turn Management: To manage latency, some participants inserted neutral fill markers ("One moment, please") to signal forthcoming contributions. Although these phrases smoothed turn transitions, they altered the register of academic discourse and introduced new conventions that may not translate beyond the immediate cohort.

These strategies reflect an emergent pedagogical ecology in which students co-construct workarounds to negotiate machine-mediated limitations. While effective in the short term, they underscore the need for integrated technological and instructional solutions that can automate glossary support, optimize processing latency, and embed repair prompts within the interface.

DISCUSSION

Nuanced Understanding of Technical Failures

This study moves beyond the quantification of machine-translation error rates by revealing how technical-term mistranslations permeate the very fabric of graduate-level discourse. When specialized historiographical or cultural vocabulary is rendered inaccurately, participants must divert time and cognitive resources to repair sequences, undermining the coherence of arguments and eroding trust in peer contributions. Unlike prior work that simply tallies translation inaccuracies (Johnson et al., 2023; Maylis, 2024), these qualitative insights demonstrate that a single mistranslation can cascade into broader semantic confusion—students hesitate to introduce novel concepts for fear of misinterpretation, and subsequent debate becomes superficial. By illuminating these pragmatic and social consequences, the present findings call for a reconceptualization of translation-tool evaluation metrics: accuracy must be assessed not only by raw error counts but also by the extent to which mistranslations disrupt argumentative scaffolding and group dynamics within high-stakes academic settings.

Latency as a Cognitive and Social Barrier

Although existing research has acknowledged translation latency as a hindrance to comprehension, this study underscores its deeper ramifications for participation and conversational ownership. Even delays as brief as one or two seconds can lead to conversational overlaps, awkward silences, and premature floor relinquishment (Wang et al., 2021; Xin & Isa, 2024). Participants reported self-regulating their contributions—shortening sentences or avoiding complex syntax—to minimize processing lag, but this strategy sacrifices the analytical depth and nuance expected at the master's level. Moreover, latency-induced pauses were sometimes misread by interlocutors as signs of disengagement or confusion, triggering unintended intercultural misinterpretations. These findings highlight latency as a dual-edged barrier: it imposes additional cognitive load on speakers and reshapes the emergent norms of turn-taking, thereby altering the very conventions of scholarly dialogue.

Preservation of Rhetorical and Cultural Nuance

A critical gap in both translation algorithms and pedagogical preparation was revealed through the loss of culture-bound rhetorical devices. Graduate seminars rely on discursive markers—emphatic particles, idiomatic metaphors, and contrastive structures—that guide listener inferences and strengthen argumentative persuasiveness. When a proverb or discourse marker is mistranslated or omitted, interlocutors lose essential cues for interpreting stance and intent. For example, the flattening of Greek contrastive particles and the literal rendering of Chinese idioms not only stripped arguments of their rhetorical force but also inhibited participants from offering or accepting critical feedback. This dimension of mistranslation has been largely overlooked in prior evaluations (Nguyen & Smith, 2024), which tend to focus on lexical accuracy rather than on the preservation of discursive function. The study's qualitative evidence thus foregrounds an urgent need for translation-tool development to incorporate rhetorical modeling and for pedagogical interventions to equip students with strategies for clarifying nuanced meaning.

Emotional Dynamics in Machine-Mediated Intercultural Anxiety

The interplay between technical failures and emotional responses emerged as a defining feature of the translation experience (Xia et al., 2024). Participants recounted how repeated mistranslations and disrupted turn-taking generated frustration, embarrassment, and anticipatory anxiety—emotions that align with established models of intercultural language anxiety (Brown & Ahmed, 2023; Kumar & Lee, 2023). These emotional burdens manifested in self-censorship, with students withdrawing from discussion after experiencing public repair sequences or failed translations. Conversely, those with higher bilingual confidence demonstrated resilience, reframing errors as opportunities for clarification rather than as personal shortcomings. By situating affective responses within the context of technology-mediated academic collaboration, this study enriches theoretical models of intercultural anxiety, revealing how digital barriers can amplify emotional stress and influence participation trajectories.

Implications for Pedagogy

The findings suggest that instructors can play a pivotal role in mitigating translation-related challenges through targeted pedagogical protocols. First, co-creation of discipline-specific glossaries prior to seminars empowers students to preempt technical-term errors and fosters shared semantic ground. Second, explicit turn-taking signals—such as visual cues or standardized filler phrases—can accommodate processing latency by managing

conversational expectations. Third, modeling peer-supported repair strategies during initial sessions can reduce emotional barriers; by normalizing clarification requests and demonstrating corrective paraphrasing, instructors can create a psychologically safe environment that encourages continued engagement. Embedding these protocols into course design and orientation activities is essential to leveling participation and preserving the depth of scholarly exchange.

Implications for Software Design

Translation-application developers should prioritize domain customization and real-time transparency features. User-editable glossaries that feed directly into translation memories would automate the resolution of technical-term mistranslations and reduce preparatory burdens on students. Latency could be minimized through optimized model architectures—such as edge computing or model pruning—that shorten processing pipelines without sacrificing accuracy. Moreover, interfaces might integrate real-time confidence scores, prompting users to verify or choose alternate translations when algorithmic certainty is low. Incorporating discourse-level modeling to preserve rhetorical markers—emphatic particles, idioms, and contrastive structures—would further safeguard the integrity of academic arguments. Collectively, these enhancements would transform translation tools from reactive correction engines into proactive collaborative partners in scholarly dialogue.

By detailing the linguistic, temporal, rhetorical, and emotional dimensions of Sino–Greek master's students' experiences with real-time translation applications, this study addresses the research questions in a holistic manner. It illuminates how technical failures ripple through argumentation and social dynamics, how latency reshapes emergent communicative norms, how translation algorithms neglect rhetorical nuance, and how these factors coalesce to influence affective responses and participation patterns. The actionable recommendations for pedagogical protocol and software design offer a dual pathway to fostering equitable, effective multilingual academic collaborations. In embracing these strategies, educators and developers can work synergistically to ensure that the promise of real-time translation in higher education is realized without compromising the scholarly depth and intercultural engagement that define graduate-level discourse.

CONCLUSION

This phenomenological study investigates the challenges faced by Sino-Greek master's students using real-time translation applications during online academic discussions. The study identifies four primary issues: frequent mistranslation of discipline-specific terminology, latency-induced disruptions in turn-taking, loss of rhetorical and cultural nuance, and negative emotional and participation impacts. These challenges often arise because machine translation tools struggle to accurately translate technical jargon, leading to confusion and misunderstandings. Additionally, the processing delay in translation causes disruptions in the flow of conversation, making turn-taking more difficult. The translations also fail to capture the subtleties of tone, rhetorical strategies, and cultural context, which diminishes the depth and richness of communication. Finally, students experience frustration and disengagement due to the slow response times and lack of confidence in the accuracy of the translations, negatively impacting their emotional well-being and participation.

To overcome these challenges, students employed a range of adaptive strategies, including using pre-shared glossaries, code-switching to English, and asking for clarification from their peers. While these strategies helped mitigate some issues, they also introduced additional cognitive and collaborative burdens. For instance, students often had to switch

between languages or rely on peers to clarify meaning, which slowed down the discussion and added cognitive strain.

By focusing on the lived experiences of a small group of master's students in intercultural seminars, the study extends previous research on translation-tool accuracy and intercultural anxiety. It highlights how the technical limitations of machine translation affect argumentation structures, emotional dynamics, and the development of communicative conventions in intercultural dialogue. This approach offers a more holistic view of the role of translation in graduate-level communication, particularly in the context of multilingual academic discussions.

The study provides several recommendations for instructors and developers. Instructors can help alleviate misunderstandings by co-creating discipline-specific glossaries with students before seminars. They should also establish clear turn-taking signals to account for translation latency and model peer-supported repair strategies during initial seminar sessions. Implementing these strategies can reduce emotional barriers, improve participation, and streamline communication. Developers are encouraged to integrate user-editable glossaries into translation applications, allowing students to customize translations more effectively. They should also work to reduce latency by optimizing processing models and include real-time confidence indicators to alert users when translations may be inaccurate, prompting them to verify or select alternate translations.

The findings of this study are limited by several factors, including the small sample size (N=4), the focus on a single institution's history and culture seminars, and the reliance on self-reported experiences and chat-log artifacts. These limitations restrict the generalizability of the results and may not fully capture the diversity of translation-tool interactions across different disciplines or proficiency levels. Future research should involve larger and more diverse cohorts, incorporate additional language pairs such as Sino-Spanish or Greek-English, and employ longitudinal designs to track how adaptive strategies and communicative norms evolve over time. Combining quantitative measures of participation and learning outcomes with qualitative insights could provide a more comprehensive understanding of real-time translation's role in multilingual higher education.

REFERENCES

Alenazi, Y. (2022). Semantic Lexical Error Analysis. New Frontiers in Translation Studies, 14(2), 99–130. https://doi.org/10.1007/978-981-19-6390-2_5

Alhazmi, A. A., & Kaufmann, A. (2022). Phenomenological Qualitative Methods Applied to the Analysis of Cross-Cultural Experience in Novel Educational Social Contexts. Frontiers in Psychology, 13(1), 1–12. https://doi.org/10.3389/fpsyg.2022.785134

Avon, J., Houston, A., Nunes, C., & Perkins, A. (2021). Using Digital Scholarship Methods and Tools to Enhance and Transform Learning during COVID-19 at a Liberal Arts College. New Review of Academic Librarianship, 27(3), 301–321. https://doi.org/10.1080/13614533.2021.1983849

Avon, J., Houston, A., Nunes, C., & Perkins, A. (2021). Using digital scholarship methods and tools to enhance and transform learning during COVID-19 at a liberal arts college. New Review of Academic Librarianship, 27(3), 301–321. https://doi.org/10.1080/13614533.2021.1983849

Borucki, I. (2017). A Visual Data Collection Method: German Local Parties and Associations. Connections, 37(1-2), 45–52. https://doi.org/10.21307/connections-2017-003

Braun, V., & Clarke, V. (2020). One Size Fits all? What Counts as Quality Practice in (reflexive) Thematic analysis? Qualitative Research in Psychology, 18(3), 328–352. https://doi.org/10.1080/14780887.2020.1769238

Braun, V., & Clarke, V. (2022). Conceptual and design thinking for thematic analysis. Qualitative Psychology, 9(1), 3–26. https://doi.org/10.1037/qup0000196

Chitrakar, N., & P.m, D. N. (2023). Frustration and its influences on Student Motivation and Academic Performance. International Journal of Scientific Research in Modern Science and Technology, 2(11), 01–09. https://doi.org/10.59828/ijsrmst.v2i11.158

Dhawan, S. (2020). Online learning: A panacea in the time of COVID-19 crisis. Journal of Educational Technology Systems, 49(1), 5–22. https://doi.org/10.1177/0047239520934018

Forbes, K., Evans, M., Fisher, L., Gayton, A., Liu, Y., & Rutgers, D. (2021). Developing a multilingual identity in the languages classroom: the influence of an identity-based pedagogical intervention. The Language Learning Journal, 49(4), 433–451. https://doi.org/10.1080/09571736.2021.1906733

Gómez, M. D., Paredes, M., Hernández, R. D., & Fuentes, J. A. (2022). Analysis of emotions in the use of augmented reality technologies in education: A systematic review. Computer Applications in Engineering Education, 13(2), 1–24. https://doi.org/10.1002/cae.22593

Green, J. K. (2021). Designing Hybrid Spaces for Learning in Higher Education Health Contexts. Postdigital Science and Education, 4(1), 93–115. https://doi.org/10.1007/s42438-021-00268-y

Ham, Y., Kim, J.-H., Min, S., Kim, D., Li, T., Timmermann, A., & Stuecker, M. F. (2023). Anthropogenic fingerprints in daily precipitation revealed by deep learning. Nature, 8(2), 1–24. https://doi.org/10.1038/s41586-023-06474-x

Hermawan, D. (2021). The Rise of E-Learning in COVID-19 Pandemic in Private University: Challenges and Opportunities. IJORER : International Journal of Recent Educational Research, 2(1), 86–95. https://doi.org/10.46245/ijorer.v2i1.77

Ivana, O., Zoulias, E., & Mantas, J. (2024). Progress Achieved, Landmarks, and Future Concerns in Biomedical and Health Informatics. Healthcare, 12(20), 2041–2041. https://doi.org/10.3390/healthcare12202041

Jagannath, A., Jagannath, J., & Kumar, P. S. P. V. (2022). A comprehensive survey on radio frequency (RF) fingerprinting: Traditional approaches, deep learning, and open challenges. Computer Networks, 219(1), 109455. https://doi.org/10.1016/j.comnet.2022.109455

Karim, A., Chowdhury, T., Karim, A., & Ahmed, A. (2024). The Impact of Educational Management on the Higher Education: International Perspective. International Journal of Academic Research in Business and Social Sciences, 14(1). https://doi.org/10.6007/ijarbss/v14-i1/20462

Kumar, A., Saini, S., Anvikar, A., Mishra, N., & Misra, G. (2025). Evolving Landscape of Emerging Virus Diagnosis: Challenges and Innovations. Molecular Biotechnology, 13(5), 1–24. https://doi.org/10.1007/s12033-025-01385-w

Liu, C., Su, M., Xiang, Y., Huang, Y., Yang, Y., Zhang, K., & Fan, M. (2025). Toward Enabling Natural Conversation with Older Adults via the Design of LLM-Powered Voice Agents that Support Interruptions and Backchannels. 2, 2(6), 1–22. https://doi.org/10.1145/3706598.3714228

Liu, J., Ma, X., Wang, L., & Pei, L. (2024). How Can Generative Artificial Intelligence Techniques Facilitate Intelligent Research into Ancient Books? Journal on Computing and Cultural Heritage, 8(2), 1–18. https://doi.org/10.1145/3690391

Maylis, S. (2024). At The Heart of Digital Collaboration: Navigating Interpersonal Affective Pathways in Digitalized Work Environments. 2, 2(2), 1–18. https://doi.org/10.22439/phd.22.2024

Mu, T. L., & Thomas, M. (2021). Google Translate in academic writing: Much ado about nothing? Journal of Second Language Writing, 52, Article 101291. https://doi.org/10.1016/j.jslw.2020.101291

Nashid , N., Kostogriz, A., & Hossain, I. (2024). Hybrid professional identities: exploring non-native English-speaking teachers' lived experiences through the Cyborg Manifesto. Pedagogy Culture and Society, 14(6), 1–23. https://doi.org/10.1080/14681366.2024.2409731

Nashid, N., Kostogriz, A., & Hossain, I. (2024). Hybrid professional identities: Negotiating machine translation in teacher education. Pedagogy, Culture & Society, 32(2), 341–361. https://doi.org/10.1080/14681366.2024.2409731

Nguyen, P., & Smith, J. (2024). Domain adaptation for translation tools: Evaluating glossary integration in educational settings. Educational Technology Research and Development, 72(1), 59–82. https://doi.org/10.1007/s11423-023-10204-5

Nicolaidou, I., Pissas, P., & Boglou, D. (2021). Comparing immersive Virtual Reality to mobile applications in foreign language learning in higher education: a quasi-experiment. Interactive Learning Environments, 2(2), 1–15. https://doi.org/10.1080/10494820.2020.1870504

O'Dowd, R. (2021). What do students learn in virtual exchange? A qualitative content analysis of learning outcomes across multiple exchanges. International Journal of Educational Research, 109, Article 101804. https://doi.org/10.1016/j.ijer.2021.101804

Ochoa, C., Castillo, L.-C., & Cabrera, P.-S. (2023). Mentors' and Mentees' Experiences in a Sino-Foreign Cooperative Education Programme: A Phenomenological Study in a Public University in China. International Journal of Learning, Teaching and Educational Research, 22(7), 517–534. https://doi.org/10.26803/ijlter.22.7.30

Papadopoulos, K., & Li, H. (2023). Synchronous multilingual seminars: Bridging intercultural academic collaborations. Journal of Intercultural Communication Research, 52(1), 1–19. https://doi.org/10.1080/17475759.2023.1881742

Phung, P. T., Minh, T., Nguyen, A. T. V., Anushka , S., & Alrence , H. (2024). A bibliometric perspective: three stages of green knowledge management thematic evolution in business literature. VINE Journal of Information and Knowledge Management Systems, 2(2). https://doi.org/10.1108/vjikms-02-2024-0079

Puar, J. K. (2017). Terrorist Assemblages: Homonationalism in Queer Times. Choice Reviews Online, 14(2), 1–24. https://doi.org/10.1163/2468-1733_shafr_sim260060051

Sackett, B. (2024). Ghosted: Challenges to Conducting Qualitative Research in the Digital Era. Journal of Contemporary Ethnography, 53(4), 1–18. https://doi.org/10.1177/08912416241237543

Skantze, G., & Irfan, B. (2025). Applying General Turn-Taking Models to Conversational Human-Robot Interaction. 2016 11th ACM/IEEE International Conference on Human-Robot Interaction (HRI), 8(2), 859–868. https://doi.org/10.1109/hri61500.2025.10973958

Smith, J. A., Flowers, P., & Larkin, M. (2009). Interpretative phenomenological analysis: Theory, method and research. Sage Publications.

Sun, D. (2017). Application of Post-Editing in Foreign Language Teaching: Problems and Challenges. 2, 13(7), 1–5. https://doi.org/10.3968/9698

Wang, X., Xu, J., & Müller, M. (2021). Latency and learner engagement: The hidden cost of real-time translation. Language Learning & Technology, 25(2), 33–48. https://doi.org/10125/44612

Xia, Y., Shin, S.-Y., & Kim, J.-C. (2024). Cross-Cultural Intelligent Language Learning System (CILS): Leveraging AI to Facilitate Language Learning Strategies in Cross-Cultural Communication. Applied Sciences, 14(13), 5651. https://doi.org/10.3390/app14135651

Xin, Y., & Isa, Z. (2024). Research on the Status Quo of Cross-Cultural Education in Chinese Colleges and Universities. Journal of Digitainability, Realism & Mastery (DREAM), 3(05), 38–48. https://doi.org/10.56982/dream.v3i05.237

Zanaj, E., Caso, G., De Nardis, L., Mohammadpour, A., Alay, Ö., & Di Benedetto, M.-G. (2021). Energy Efficiency in Short and Wide-Area IoT Technologies—A Survey. Technologies, 9(1), 22. https://doi.org/10.3390/technologies9010022

Zappatore, M. (2023). Incorporating Collaborative and Active Learning Strategies in the Design and Deployment of a Master Course on Computer-Assisted Scientific Translation. Technology, Knowledge, and Learning, 13(7), 1–18. https://doi.org/10.1007/s10758-023-09679-1

Zhang, H. (2024). The Impact of English Language Development on Internationalization of Education. Lecture Notes in Education Psychology and Public Media, 34(1), 243–249. https://doi.org/10.54254/2753-7048/34/20231933