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LEGITIMIZING BILINGUAL PEDAGOGIES: A CONVERSATION ANALYTIC STUDY OF ENGINEERING KNOWLEDGE CONSTRUCTION IN PAKISTANI TERTIARY CLASSROOMS

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Abstract
This conversation analytic study investigates how bilingual practices facilitate engineering knowledge construction in Pakistani university classrooms, where English Medium Instruction (EMI) policy encounters the linguistic realities of Urdu-English bilingualism. Drawing on 42 hours of video-recorded lectures from three HEC-recognized public engineering universities, we examine the sequential organization of translanguaging in conceptual scaffolding. Findings reveal that instructors systematically deploy bilingual practices in three interactional loci: (1) other-initiated repair sequences where Urdu clarifications re-establish intersubjectivity after student confusion displays; (2) knowledge-display elicitations where English technical questions are prefaced with Urdu affective framings; and (3) epistemic stance negotiations where code-switching marks transitions between procedural and conceptual registers. Contrary to EMI policy assumptions, participants treat translanguaging not as compensatory deficit but as an accountable pedagogical resource strategically calibrated to epistemic gradients. The study offers micro-empirical evidence for legitimatizing planned translanguaging in Pakistan's Global South higher education context, challenging monoglossic ideologies that obscure the interactional work of knowledge co-construction.

Keywords: *Conversation Analysis, translanguaging, Pakistani English, engineering education, bilingual classroom interaction, English Medium Instruction, epistemic stance.*

1. Introduction

A major contradiction of the institutional landscape of higher education in Pakistan lies in the fact that whereas the Higher Education Commission has ordered English the sole medium of instruction (EMI) in the science and engineering programmes (HEC, 2018), the reality on the ground in the classroom can be described as a strong duo of bilingualism where Urdu and English are the vectors of teaching and learning (Mansoor, 2005; Mahboob, 2014). This policy-pedagogical tension is especially dramatic in faculties of engineering, where the complexity of concepts requires a fine epistemic grasp, and the students with different levels of English proficiency provide an ongoing understanding gap (Rahman, 2019). This instructional quandary between following the strict EMI prescription and the calculated utilization of the complete linguistic arsenal of students does not manifest itself in the policy architects due to its ability to bubble down to the micro-level of turn-taking classroom interaction (Jakonen and Morton, 2015).

More recent research in the field of applied linguistics has criticized the deficit perspective of bilingual pedagogies, reconsidering code-switching as translanguaging as a dynamic and

motivated use of unilingual resources to make meaning (García and Li Wei, 2014; Canagararajah, 2011). It is viewed within this paradigm that bilingual practices are not indicators of their incomplete acquisition of the English language but advanced pedagogical planning of scaffolding disciplinary knowledge (Lin, 2013). Nevertheless, a large part of translanguaging studies is based on teacher interview, or macro-level policy analysis, and little is known about the interactional mechanics of how being bilingual can help to construct engineering knowledge. Pakistan particularly is problematic because the language politics in post-colonial Pakistan and the economic demands of the world offer specific conditions under which the bilingual pedagogy would flourish (Mansoor, 2005).

This gap is filled by the study with Conversation Analysis (CA), a methodology of its own that is best positioned to unveil how participants anchor on bilingual practices, in order to be presented as systematic and accountable resources in real-time knowledge construction (Sacks et al., 1974; Schegloff, 2007). The sequential analysis and next-turn proof procedure that CA insists upon helps us to go beyond the descriptive assertions about translanguaging to prove empirically how code-switching fulfills certain pedagogic tasks, repair, and clarification, and affective framing, the conceptual work needed by engineering education.

Our research questions are:

1. What sequential patterns organize translanguaging for conceptual scaffolding in Pakistani engineering classrooms?
2. How do participants display orientation to bilingual practices as accountable pedagogical resources?
3. What implications do these micro-interactional findings hold for EMI policy legitimacy in Pakistan's Global South context?

Locating the interrogative in the context of the engineering classrooms, where the worlds of technical language and abstract thinking meet, we expose the much-vast labor that bilingual educators put into making disciplinary knowledge available. This micro-empirical finding not only contributes to an expanding literature of conversation-analytic research of classroom discussion but it also provides insights into the current policy debates in Pakistan with regard to the medium of instruction.

2. Literature Review

The language-in-education policy of Pakistan has blazed a path of increasing ambitions to an English-medium (EMI) aspiration since its independence. This has been accelerated by the 2009 National Education Policy which made English the key to global competitiveness; followed by the 2018 guidelines of the Higher Education Commission that required English as the only medium of all the science and technology programmes (HEC, 2018). This policy reflects the concept of linguistic imperialism proposed by Philipson (1992) of the unquestioning extension of the crown of glory to English as the only means of scientific modernity, which forces out such native languages as Urdu, which plays a massive functional role in the academic discourse (Rahman, 2019).

Empirical research always records an absence of correspondence between policy and practice. The historic survey of 2,000 Pakistani undergraduate engineering students by Mansoor (2005) revealed that 78 per cent of students said that they only partially understood what was being said during EMI lectures, and one-third of them acknowledged that they depended upon Urdu clarifications offered by other students after the lesson. Rahman (2019) repeats that faculty in engineering

practise behind the scenes what they publicly advocate EMI to protect institutional legitimacy. It is a schizophrenic practice, what Mahboob (2014) refers to as Englishisation without English, which creates a kind of hidden curriculum, according to which bilingualism is both indispensable and stigmatized.

The disgrace associated with this duality is ideologically charged. Such a policy of the HEC as the Medium of Instruction was a result of the World Bank conditionalities, which conditionalities bound funding with the adoption of English-median, the policy of which can be considered a typical example of that Canagararaj (2011) discusses: vernacular access is the accomplice of global capital. As the bridges to global labour markets, engineering faculties are under a special acute pressure to present monolingual Englishness and secretly use Urdu to gain deeper conceptual insights (Ahmed & Mahmood, 2020).

The fact that the theoretical shift of the term code-switching to translanguaging alters the concept of bilingualism as a single semiotic system instead of two monolingual ones (García and Li-Wei, 2014). The study of translanguaging in the STEM environment specifically explains how it can be used in the so-called concrete modelling - relying on the L1 to ground abstract concepts in L2 (Lin, 2013). Bilingual scaffolding is epistemically necessary where the technical accuracy and intuitiveness of conceptual metaphors like entropy as disorder is essential (Jakonen and Morton, 2015).

However, the majority of the scholarship work on translanguaging is on the macro level. The article by Li -Wei (2018), entitled Translanguaging as a Practical Theory of Language, provides a philosophical foundation but has little interactional substance. The articles on applied linguistics both in Hong Kong (Lin, 2013) and in Malaysia (Then & Ting, 2011) enlighten us on the role of translanguaging in science lessons, but neither of these places reflects the Pakistani post-colonial language hierarchy and institutional surveillance. According to Amir and Musk (2013), who suggest South Asia, translanguaging needs to be challenged as political performance, every utterance of a bilingual negotiates conceptual understanding and institutional validity.

2.1 Classroom Interaction and Conversation Analysis.

The use of CA in the learning institutions reveals the process of coordination of learning through sequential arrangement. The canonical IRE (Initiation Response Evaluation) pattern presented by Mehan (1979) illustrates the way in which the discourse in a classroom organizes the conveyance of knowledge. In more recent times, CA scholarship has investigated the interaction on a bilingual classroom, which is centered on:

• Repair organization: Jakonen (2018) demonstrates that represented epistemic asymmetries in terms of teacher and student arise in repair sequences indexed by code-switching.

• Epistemic position: Heritage (2013) shows that the epistemic status (who knows what) is indexed through lexical choice and turn design.

• Multilingual interaction Multilingual conversation: Gafaranga (2000) constructs medium repair as a CA concept of bilingual conversation, and Amir (2013) uses CA to bilingual classroom code-switching.

Of importance in this research, CA has a next-turn proof procedure, which permits us to show participant orientation. When a student reacts to Urdu clarification with a sign of comprehension (“acha, ab samajh aya") and the teacher goes on in English, this cycle proves that translanguaging

has done pedagogical labor. In the absence of this sequential evidence, statements about bilingual scaffolding are hypothetical.

2.2 Research Gaps and Rationale of the Study

Although this theoretical maturation exists, three gaps still exist:

1. Empirical silence of Pakistani engineering classrooms: No CA based study has reported the way in which translanguaging positively influences the construction of technical knowledge in the EMI monitored classroom situation in Pakistan.
2. Due deficiency in sequential analysis: The majority of studies on bilingualism in Pakistan have been done via surveys or interviews, and there is no real-time interactional research (Mansoor, 2005; Rahman, 2019).
3. Policy disconnect: The monolingual policy of EMI that HEC has enforced is not grounded in micro-empirical research of the actual construction of knowledge in bilingualism.

The research paper meets these gaps by presenting the primary conversation-analytic explanation of the engineering knowledge building in Pakistani universities. We can play the twofold role of (a) proving the systematic application of translanguaging in conceptual scaffolding, and (b) provide empirical evidence to legitimise the use of bilingual pedagogies in policy.

3. Methodology

3.1 Research Design

Conversation Analysis is used as a theoretical framework and a methodology in this study (Sacks et al., 1974; Schegloff, 2007). The key strength of CA is its ability to display the emic organisation of social action which is the orientation of participants towards, production as well as interpretation of bilingual practices in the moment. In contrast to ethnography that uses retrospective reports or the aggregation of patterns that mixed methods requires, CA asks one to respond tirelessly to sequential evidence: what participants do as the conversation progresses on a turn-by-turn basis.

Our design is based on the observation of real classroom environment. We embrace the concept of unmotivated looking by Jakonen and Morton (2015), who start with no codes and leave tendencies to appear naturally. This would be necessary in trying to avoid the confirmation bias that plagues numerous studies in translanguaging that researchers tend to see what they think they are supposed to (Li-, 2018).

3.2 Sites and participants of the research

In Pakistan, three popular universities of engineering in Punjab were selected to represent the most favored model of engineering education in the country. Such universities are the University of Engineering and Technology (UET), Lahore (W4-category), the Government University of Engineering and Technology, Taxila (W4-category), the Ghulam Ishaq Khan Institute (GIKI), Topi (W3 2d category, private). These institutions were chosen to offer a wide diversity of engineering courses and types of institutions. Higher Education Commission Engineering Management Institutions (HEC EMI) pays close attention to public universities such as UETs, whereas GIKI has a semi-autonomous status, and thus, it may not face a relevant scrutiny of the bilingualism practice. This is a wide range of choices that will provide a solid picture of engineering education in the various kinds of institutions.

Participants.

The study included four instructors (three men and one woman), selected purposefully based on recommendations from the department chairs who identified them as effective communicators. The participants were between 35 and 52 years old, with eight to twenty years of teaching

experience. All instructors held either M.Sc. or Ph.D. degrees obtained from Pakistan, the UK, or the US. As for the students, the entire groups were included, with data naturally recorded from 3540 students per class, resulting in 115 student participants across the three sites. The gender distribution was reflective of the engineering field, with approximately 85-95% male students and 15-18% female students in co-ed settings. Regarding access and ethics, the study followed necessary protocols: a No-Objection Certificate (NOC) was obtained from the respective ORIC offices of each university (a three-month process), and approval was granted by the department chairs via official letters. Instructors provided opt-in consent, while students consented to participate, with the right to withdraw from the video frame if desired. The study also received IRB approval from the university of the author. To ensure confidentiality, all respondents were assigned pseudonyms, and institutional names were anonymized in the transcripts, though they were not anonymized in the field notes.

3.3 Data Collection Procedures

The protocol to be used during recording of this study included the utilization of two Canon Vixia HF R800 camcorders to record the faces of both the instructor and the student as well as the use of a backup audio recorder, Zoom H1n. The cameras were also positioned strategically at the corners of the rooms in the back and the instructor had a lapel wireless microphone. The research lasted 14 weeks of the semester, and the three sessions were noted to each instructor (once a month) to observe the changes in the rhythm of instructions. The total number of hours of video recorded was 126 hours, which is 42 hours of filmable time, which could be analyzed, excluding labs, examinations, and silent working time. During the sessions fieldnotes were recorded giving a detailed account of the seating plan, board work, student inquiries, and after and before class activities, and post-interview comments on the part of the instructor, which were collected using brief post-session interviews of 10-15 minutes.

To manage the data, the files were uploaded every day in encrypted external disks and sorted by instructor and course (e.g., UETLahoreThermodynamics). The transcription was commenced at the end of the first month of data collection to educate the continued data collection. It was transcribed according to Jeffersonian conventions (Jefferson, 2004) and was grounded on the bilingual data transcription procedures (Gafaranga, 2000) and Amir (2013). The transcription and analysis structure will be addressed in the corresponding section of the research.

Key Adaptations for Urdu-English:

- Language tagging: ((U)) for Urdu, ((E)) for English (when ambiguous)
- Retroflex sounds: ↑ before Urdu retroflex consonants (e.g., ↑samajh)
- Lengthening: :: applies across both languages
- Aspiration: hh for Urdu breathy consonants
- Translation: Gloss provided immediately below line; idiomatic translation in italics

Transcript Example (Simulated):

01 TARIQ: The entropy of an isolated system never:: decreases. (0.5)
02 ((U)) matlab ye kya? ((/U))
03 meaning this what?
04 "What does this mean?"
05 ALI: ((U)) sir ↑samajh nahi aya ((/U))
06 sir understand not came
07 "Sir, I didn't understand"

08 TARIQ: ((U)) dekhiye:: ((/U)) look-POL::-IMP
09 Look:: (0.2) ((points to board)) entropy is like disorder. (0.3)
10 ((U)) agar koi system hai, aur usmen energy distribute ho rahi hai ((/U))
11 if any system is, and in-it energy distribute is happening
12 "If there's a system, and energy is distributing in it"

Software

The current study used ELAN (Version 6.4) to do multi-tier annotation of classroom activity. The data was coded using five parallel levels, namely: the primary transcript, English gloss, original Urdu speech, gaze direction, and gesture marks.

Analytical Procedure

1. Unmotivated looking (Weeks 1–16). The whole 42 hours of recording were also watched multiple times, and the first impressions were directed at the events that were considered interesting with respect to the topic of bilingual activity.
2. Collection-building (Weeks 17–24). One hundred and sixtyseven different sequences where the process of translanguaging was observed in the context of explanations were found and listed.
3. Coding for phenomena. The identified cases were classified into four thematic groups, namely, repair, elicitation, framing, and assessment.
4. Fine-grained analysis (Weeks 25–40). Turn by turn analysis was done by the next-turn proof procedure with deviant-case analysis performed to elicit edge conditions.
5. Member checking. The coded transcripts were reviewed by three senior instructors; reflective annotations of senior instructors were incorporated as corroborating evidence.

Positionality, Trustworthiness.

Being a Pakistani researcher whose background was in applied-linguistics field and that of an insider-outsider (previously being an engineering student, and now an ELT scholar), I added some emic sensitivity to the cultural issues and etic analytical distance. The credibility was strengthened with:

Peer debriefing: weekly analytic meetings with a co-researcher specialist in the Conversation Analysis.

Deviant-case analysis: focused search of the situations in which the use of translanguaging failed to scaffold comprehension.

In a collection of twelve sequences, where Urdu clarification did not incite student uptake, negatively-instance collection was carried out to define boundary conditions on the claims.

Reflexivity journal: A journal that is kept during fieldwork and records instances when my personal identity as a bilingual was likely to bias observations.

Results: Interactional Architecture of Translanguaging.

This analysis shows that code-switching in the Pakistani engineering environments is not an improvised phenomenon but is a strategically structured interactive resource used in significant points of knowledge building. In the seventy-seven sequences under investigation, it turns out that translanguaging is the system of pedagogical scaffold at the level of sequential contingency, i.e., the point of breakdown of understanding, crossing of conceptual threshold, and negotiation of the epistemic stance. Four fundamental phenomena are provided in the next section and explain how

the participants capitalize on bilingualism as a trustworthy source of engineering knowledge building.

4.1 Translanguaging in Other-Initiated Repairs.

The most common pattern (n 28) is that of translanguaging as part of other initiated repair (OIR) whereby a student misconception evokes bilingual explanation. This pattern is illustrated by the example of Extract 1 which was taken in a lecture at Thermodynamics at UET Lahore. The teacher, Dr. Tariq has recently presented the concept of reversible processes with the help of English technical register.

Extract 1: OIR Sequence in Entropy Explanation

01 TARIQ: A reversible process is one where the system and surroundings
02 can be restored to their initial states without any change in the
03 universe. (0.8) So the entropy change is zero. (1.2)
04 ASIF: ((raises hand)) Sir, ((U)) zero kyun? ((/U))
05 zero why?
06 "Sir, why zero?"
07 TARIQ: ((U)) matlab? ((/U))
08 meaning?
09 "What do you mean?"
10 ASIF: ((U)) matlab ye kya hai reversible? hum ne pehle kabhi suna nahi ((/U))
11 meaning this what is reversible? we have before ever heard not
12 "I mean what is reversible? We've never heard this before"
13 TARIQ: ((U)) acha suno:: ((/U)) okay listen-IMP
14 (0.3) imagine you have a piston. (0.2) You compress it slowly::,
15 (0.5) then you expand it slowly::. (0.8) If you do it infinitesimally,
16 you can go back and forth. (0.3) ((U)) samjhe? ((/U))
17 understand?
18 "Understand?"
19 ASIF: ((U)) haan sir, ab samajh aya ((/U))
20 yes sir, now understanding came
21 "Yes sir, now I understand"
22 TARIQ: So that's reversible. (0.2) Entropy doesn't change. (0.5) Next concept-

Turn-by-Turn Analysis:

It begins with the pronunciation of Tariq of the professional definition of the term English (lines 01-03) with intentional pauses of 0.8 s and 1.2 s giving the speech the conceptual seriousness. The hand-raise and the bilingual question of ASIF, who asks zero kyun? has triggered the repair, is not based on an acknowledgment of linguistic incomprehensibility but an attack on the causal reasoning behind the technical assertion (line 04). The Urdu “kyun” (why) functions as a precise interactional device: it marks a lacuna in causal reasoning rather than mere lexical ambiguity, thereby asserting epistemic entitlement to conceptual depth (Heritage, 2012).

The repair cue of TARIQ is important (matlab?). By using Urdu to request further clarification of the clarification, he also code-switches, which shows that he is sensitive to the language preference of ASIF but at an interactionally salient level. This is not simply accommodation and is instead a design of the recipient response which is a turn structure is modified to demonstrate responsiveness to the epistemic position of the student (Schegloff, 2007). The interjectionary pause of 0.3 s at the

time when TARIQ switches to Urdu (line 13) indicates a change of the frame of reference framed by exposition to meaning-making.

Graduated scaffolding is the case with the focal repair sequence (lines 14-16). TARIQ opens with the tangible English imagery, where he uses piston, compress, expand, one can see that this is a deictic form of grounding, and then proceeds to the Urdu verbs which are grounded in a process, suno, samjhe and indicates that the explanation is going to be pedagogically modulated. The final tag query samjhe (understand?) is an epistemic check that is translated into the repair language that in turn creates a bilingual feedback loop (Gafaranga, 2000). The evidence in next-turn in ASIF provided by the change-of-state token (ab samajh aya) in line 19 allows continuing to believe that the translanguaging repair fulfilled its didactic purpose, allowing TARIQ to continue with an English technical register in line 22.

Sequential Pattern Identified:

English Technical Claim Student Bilingual OIR Teacher Bilingual Repair.

Student Achievement Shown — Teacher Back to English Register.

This trend shows that translanguaging is not deficit, rather, it is an epistemic work that is interactionally tuned. The English-to-Urdu-to-English flow perfectly fits the sandwich structure of the studies of bilingual pedagogy (Jakonen and Morton, 2015), but according to Conversation Analysis, the sequential warrant is to be observed: once the Urdu repair stimulates the students to respond, the teacher considers the idea stabilized enough to switch to English.

4.2 Knowledge Display Elicitations Bilingual Framing.

A second prominent trend (n=19 sequences) involves instructors using Urdu to introduce English technical elicitation thus creating an affective and epistemic contact. In the extract given in UET taxila course on Circuit Analysis, Dr. Fatima introduces the students to a difficult conceptual question about a theorem of Thevenin.

Extract 2: Bilingual Preface in Elicitation Sequence

01 FATIMA: Today we'll solve a complex circuit. (0.5) ((U)) dekhiye,
02 agar aap ko yeh circuit samajh nahi aye ga,
03 to_next sawal bilkul solve nahi kar payein ge ((/U))
04 look-POL if you-DAT this circuit understand not come-FUT
05 then next question absolutely solve not able-FUT
06 "Look, if you don't understand this circuit, you won't be
07 able to solve the next question at all"
08 FATIMA: ((U)) isliye main dubara explain karungi, aur phir
09 aap bhi kuch bataein ge ((/U)) (0.3)
10 therefore I again explain do-FUT, and then you also
11 something tell-FUT
12 "Therefore I'll explain again, and then you'll also
13 tell me something" (0.3)
14 FATIMA: So, what is the Thevenin voltage across terminals A and B?
15 (1.5) Anyone? (0.8)
16 AZIZ: ((U)) miss, kya hum Norton ka use kar sakte hain? ((/U))
17 miss, can we Norton of use do can?

18 "Miss, can we use Norton's theorem?"
19 FATIMA: ((U)) bilkul nahi, sawal Thevenin ki demand kar raha ((/U))
20 absolutely not, question Thevenin of demand do-PROG
21 "Absolutely not, the question demands Thevenin"
22 FATIMA: But good thinking. (0.2) Now, let's calculate V-th.

Interactional Work of Bilingual Preface:

The Urdu preface of Fatima (lines 01-03) is also a good example of metacommunicative framing as Goffman (1974) explains it. It makes it clear that the coming English technical subject is going to present heavy mental load. The deictic "dekhiye" (look) functions to capture visual focus, while the conditional construction "agar…to" (if…then) foregrounds consequentiality, thereby establishing an epistemic urgency in line with Heritage's (2012) findings. This is not a mere translation but is instead prospective indexicality where Urdu thus prepares the audience to expect that special, cognitive preparation is necessary.

More importantly, the preface also features the change in the participation structure: the command aap bhi kuch bataein ge (you will also tell me something) changes the learners into passive receivers, into active epistemic agents. The attenuation of the affective filter by linguistic choice, which is mediated by this bilateral impact, is that Urdu in line 14 weakens a disciplinary register, whereas English does not. The boundary between the code-switch and the interactionally salient stage at the beginning of the English interrogative is marked by the 0.3 seconds of pause.

This reaction of AZIZ (line 16) testifies to the effectiveness of the preface. Through the opening in Urdu he does not reject the bilingual participation system; however, his query uses technical English Norton entrenched in the Urdu grammar, a textbook instance of translanguaging. The dual format response provided by Fatima, which is Urdu prohibition and English affirmation, confirms both the linguistic repertoares and hence the validity of bilingualism in terms of epistemic negotiation.

Pedagogical Function: Urdu prefaces reduce the level of epistemic participation by the students as it does not eliminate the use of English in exposition of technical matters. This creates a bilingual zone of proximal development (Lin, 2013) where students are allowed to experiment with conceptual discourse using a familiar register and then express it in the English language.

4.3 Code-Switching as an Epistemic Stance Marker.

Language alternation is repetitively used by instructors to mark epistemic gradients by alternating between procedures (how-to) and conceptual (why) registers. Drawing on the course in Engineering Mechanics at GIKI, the Extract 3 gives an explanation of the principle of virtual work as introduced by Dr.Hassan.

Extract 3: Epistemic Stance Differentiation

01 HASSAN: The virtual work principle says (0.3) $\delta W = 0$. (1.0)
02 (writes equation on board) (2.5)
03 HASSAN: ((U)) ab:: isko apply karna hai truss pe ((/U))
04 now this-ACC apply do-INF is truss on
05 "Now we have to apply this to a truss"
06 HASSAN: Step one::, identify the redundant member. (0.5)
07 Step two::, introduce a virtual displacement. (0.5)
08 ((U)) bas, itna hi hai procedure ((/U))

09 just, this-much only is procedure
10 "That's it, this is the procedure"
11 HASSAN: ((U)) lekin::, ye kyun kaam karta hai? ((/U)) (1.0)
12 but, this why work do-PROG is?
13 "But why does this work?"
14 HASSAN: The key insight is that virtual forces don't violate
15 equilibrium. (0.8) They are:: (0.3) hypothetical.
16 STUDENT: ((U)) sir, hypothetical matlab? ((/U))
17 hypothetical meaning?
18 "Sir, what does hypothetical mean?"
19 HASSAN: ((U)) matlab farzi, imagine kiya hua ((/U))
20 meaning fake, imagine done
21 "It means fake, imagined"
22 HASSAN: So we can test equilibrium without real forces.

Stance Analysis:

In this extract, the pedagogic plan of Professor Hassan carefully traces the linguistic features on the epistemic registers. The disciplinary power of the English technical definition in line 01, and the Urdu procedural pivot ab isko apply karna hai in line 03 are indications of a change of abstract principle into concrete application. It is not a haphazard code-, here Urdu indicates the presence of a stance-, indexing: Urdu indicates the presence of a practical workbench mode, thus disconnecting the action lines (06 -07) to its theoretical rationale.

The decisive action is taken at line 11. Hassan also introduces the coming conceptual explanation with the Urdu term of lekin,ye-kyun-kaam-karta-hai? (but why does this work?). The question sets up a conceptual boundary - a metacommunicative boundary that warns the learners that the next English exposition will be concerned with a lower layer of epistemics. The meta-question is made salient by the lag of 1. 0 seconds before it.

The initiator of repair in the student (line 16) does not refer to the principle but rather to the epistemic modality “hypothetical” the meta- conceptual word. The student adheres to the bilingual paradigm that Professor Hassan has developed by using Urdu to ask the question. Hassan is glossing Urdu in line 19, farzi, imagine kiya hua; the two English terms have been compressed into more familiar Urdu ideas, an epistemic gloss -the ability to construct complexability markers using known lexical inventory.

Sequential Pattern:

English Concept English Procedural Framing Urdu Procedural Framing Urdu Meta-Conceptual Query

English Deep Exploration→ Bilingual Repair of Modal Terms.

This trend is the indication that bilingualism in the classroom is not only used to understand but be epistemically directional to allow students to differentiate between procedural implementation and conceptual justification, which is the primary issue in engineering education (Jakonen and Morton, 2015).

4.4 Evaluations Passes and Bilingual Understanding Tests.

Formative assessment is also a strategy used by instructors as a form of translanguaging to understand what the learners have understood without making English proficiency a confounding

variable. The extract 4 presents the final evaluation of a group problem-solving session by Dr. Tariq.

Extract 4: Bilingual Comprehension Assessment

01 TARIQ: ((U)) theek hai, ab main ne jo bataya, kya sab ko
02 samajh aya? ((/U)) (1.5)
03 okay is, now I-ERG what told, what everyone-DAT
04 understanding came?
05 "Okay, what I've explained, has everyone understood?"
06 SADIQ: ((U)) sir thora sa, heat transfer wala part ((/U))
07 sir little bit, heat transfer of part
08 "Sir, a little bit, the heat transfer part"
09 TARIQ: ((U)) kaunsa part? ((/U)) (0.5)
10 which part?
11 SADIQ: ((U)) wo conduction equation, T1 minus T2 ((/U))
12 that conduction equation
13 TARIQ: ((U)) Fourier's law? ((/U))
14 SADIQ: ((U)) ji sir ((/U))
15 yes sir
16 TARIQ: ((U)) kya problem hai? ((/U))
17 what problem is?
18 "What's the problem?"
19 SADIQ: ((U)) negative sign ka matlab? ((/U))
20 negative sign of meaning?
21 "What does the negative sign mean?"
22 TARIQ: Good question. (0.3) It indicates direction of heat flow.
23 (writes arrow) (0.5) ((U)) samjha? ((/U))
24 understand-PAST?
25 "Understood?"
26 SADIQ: ((U)) ji bilkul ((/U))
27 yes absolutely

Welch, over fifty years, you have earned the title of Interactional Achievement through the esteem of your classmates**.**

Assessment as Interactional Achievement:

Tariq carried out a group-level comprehension test (across line 0102) which was conducted in a bilingual manner. Grammar constructions of Urdu were mixed with English technical words- such as heat transfer part. Partially this hybrid modality minimizes the obstacle to open disclosures of partial understanding. A deliberately introduced 1.5-second pause serves as a signalling information, the frame of what is expected to be answered; the fact that SADIQ deliberately responded in Urdu at line 06 further testifies to the effectiveness of the bilingual frame.

The next stage passes on to a diagnostic evaluation. Avoiding reinventing the very complex explanation, Tariq uses Urdu interrogatives like kaunsa part? to identify the exact point of false belief namely Fourier law in line 13. It is epistemic pinpointing: the bilingual situation allows identifying knowledge gaps accurately without the need to use English lexical resources to explain the lack of understanding.

This conversation is brought to an ending with a proverb of bilingual feedback closure by Tariq in line 23. He switches to Urdu after giving an explanation in English by saying samjha? a past tense, informal, question of understanding that also keeps the teacher in control. The assertion of SADIQ about being ji bilkul concludes the chain, affirms belonging and confirms the loop of the bilingual test.

Pattern Summary:

Group Check Bilingual to Student Bilingual Self-Assessment Bilingual to Targeted Urdu Diagnostic Bilingual to English Explanation Urdu Closure.

In its turn, this tendency proves that formative assessment in bilingual education is not a device of testing the level of proficiency in English, but, in fact, an instrument of checking the level of mastering the concepts. Urdu provides the interactional scaffolding through which the utterances of candid epistemology can be made and English is still the language of technical exposition.

4.5 Summary: Systematicity of Bilingual Pedagogical Work

Table 1 synthesizes the sequential patterns identified across all 67 sequences:

Table 1: Sequential Patterns of Translanguaging in Engineering Knowledge Construction

Interactional Phenomenon	Sequential Pattern	Pedagogical Function	Frequency
Other-Initiated Repair	English claim → Urdu OIR → Bilingual repair → English resumption	Conceptual re-establishment	28/67 (42%)
Knowledge Elicitation	Urdu preface → English question → Bilingual negotiation	Affective framing & participation elicitation	19/67 (28%)
Epistemic Stance Marking	English concept → Urdu procedural → Urdu meta-query → English deep explanation	Register differentiation & conceptual deepening	12/67 (18%)
Formative Assessment	Bilingual group check → Targeted Urdu diagnostic → English explanation → Urdu closure	Comprehension verification & gap identification	8/67 (12%)

The imbalanced distribution of the practice of translanguaging makes it clear that repair is the main site where the use of bilingual interaction becomes the primary pedagogical necessity. This fact is not unusual concerning the initial understanding of conversation analysis (CA): repair is the process through which intersubjectivity is orderly sustained (Schegloff, 2007). In the field of engineering education, where conceptual gaps often lead to procedural failures, it is not possible but ontologically necessary that the conceptual gaps be repaired by use of a second language.

More importantly, these patterns are not limited to a certain instructor. The four respondents used the similar sequential formats which implied the existence of a common interactional competence (Hall and Pekarek-Doehler, 2011) of the bilingual pedagogy beyond the personal style. This skill has probably been gained through years of negotiating the bilingualities of EMI-managed classrooms in Pakistan, hence what, in its turn, Rahman (2019) refers to, as practical bilingualism (unofficial but highly structured).

5. Discussion

5.1 Translanguaging as Interactional Achievement: Theoretical Contributions.

Our results place translanguaging at a macro-level of ideology in the macro perspective to the micro-level of interaction in the micro perspective which is sequentially arranged orchestrated by patterns. Even though the theory of translanguaging proposed by Garccia and Li-Wei (2014) theorizes it as a practical theory of language, our case analysis of CA shows that such a theory has praxiological mechanisms which, in the context of engineering knowledge building, are the turn-by-turn strategies according to which its participants co-construct intersubjectivity. This is an important distinction: we show that, in their next-turn responses, students actively seek, construct and confirm translanguaging as a pedagogical choice on their part.

Repair sequences (Extract 1) serve as an example of so-called architecture of intersubjectivity (Schegloff 2007). By starting the process of repair in Urdu with ASIF (zero kyun?), he does not renounce expectations of the English medium rather exploits the resources of bilingualism to reach the causal logic of technical statements. The accommodation of TARIQ is not a bilingual repair but a gradual responsiveness, a systematic exhibition which he has also gauged as being a problem of conceptual and not a lexical trouble of ASIF. This observation contradicts the deficit models of bilingual students which dominate the discourse of Pakistani engineering education (Ahmed and Mahmood, 2020), demonstrating instead that bilingualism is the infrastructure of more epistemic work.

Our notion of epistemic stance differentiation (Extract 3) expands the work of Heritage (2013) on epistemic status by explaining the indexing of the epistemic registers by language choice itself. The Urdu procedural framing (ab isko apply karna hai) by Hassan brackets the technical English as a conceptual register and a workbench register, which is vital to the learning of engineering students who need to learn how to calculate and why principles are true. This is not a cognitive confusion, but an epistemic sophistication, a bilingual metacommunicative competence, which Pakistani engineering students acquire in spite of EMI policy limitations.

More importantly, these patterns are what we call as the work of legitimation (Goffman, 1974). In all sequences, there is a delicate equilibrium between bilingual efficacy and EMI surveillance between instructors and students. The fact that TARIQ returned to English, after the successful repair of the Urdu (Extract 1, line 22), shows that he followed monolingual codes of legitimacy, but had already completed bilingual pedagogical capital. It is temporary, focused, temporary sequential bilingualism that can provide a pragmatic policy approach: Translanguaging will not be a threat to EMI, but instead, it should be approached as scaffolding, which will result in English understanding, not its replacement.

5.2 Policy implications: Bilingual Pedagogies as legitimate in Pakistan.

Our results are empirical bullets to change the Higher Education Commission (HEC) monoglossic EMI requirements. The present policy of HEC Medium of Instruction Policy (2018) has two faulty assumptions: (a) that teaching English only assures quality, and (b) that teaching in two languages signals pedagogical ambiguity. Our data refute both. The conceptual understanding that we systematically record in translingualism benefits learning in ways that English monolingualism fails to and especially in abstract concepts of engineering, where more than one mode of representation is necessary (Lin, 2013).

Pakistani engineering education: we suggest a Strategic Translanguaging Framework:

1. Legitimize Repair Translanguaging: Institutionalize the already covert practices by the teachers. The policy of HEC ought to explicitly allow Urdu clarification during OIR sequences since it is considered as pedagogical scaffolding and not language lapse. It will need to include a Bilingual Scaffolding Clause to the Quality Enhancement Cell criteria of HEC.
2. Codify Epistemic Stance Marking Train teachers to speak Urdu when procedural framing and English when making a conceptual claim, and bilingual register differentiation is a made pedagogical competency. It coincides with the code-meshing approach to teaching language that Canagarajah (2011) explains but, once again, it is adjusted to fit the context of EMI surveillance in Pakistan.
3. Assessment Reform: Reform the use of English-only exams with bilingual formative testing to enable students to have the ability to express conceptual knowledge in Urdu and describe technical material in English. As indicated by our results (Extract 4), more accurate diagnostic information is obtained when comprehension checks are performed in Urdu than when performed in English.
4. University should protect teachers against the punitive assessment of the language. Pedagogical Autonomy Certificates should be issued in ORIC offices that outright safeguard the use of bilingual teaching in STEM classrooms.

The World Bank Conditionality: The World Bank conditionalities have also influenced the EMI policy of Pakistan as part of the funding requires engagement in adoption of English as the medium of instruction (Mansoor, 2003). Our research offers a line of evidence to trade this conditionality by redefining translanguaging as English proficiency scaffolding which is a transitory structure that facilitates, but does not undermine EMI performances. Such discursive repositioning is essential in terms of sustaining funding but permitting pedagogical realism.

Decolonizing Engineering Pedagogy: Pakistani engineering curricula are still colonized by the Anglo-American textbooks and teaching models (Mahboob, 2014). We propose that decolonial bilingual pedagogy should offer conceptual anchors to indigenous knowledge systems using Urdu and offer access to engineering discourse globally with the aid of English. This is not the additive bilingualism, but epistemic syncretism, a model that will fit the post-colonial positionality of Pakistan.

5.3 Limitations/Future Research Directions

Our claims are limited in a number of ways. To begin with, sampling limitations: Our four instructors are not representative of the 3,000 plus engineering faculty in Pakistan, but were selected purposely. There are still female instructors underrepresented (just one-quarter participants) which again is in line with the gender demographics in engineering but does not allow generalizations about how translanguaging may be applied in classrooms dominated by females (e.g. medical colleges). It should be noted that in the future the study will require sampling female engineering faculty purposely and contrasting interactional patterns.

Second, institutional type: Our sample of HEC-recognised universities has omitted unranked, privately owned engineering colleges where the impetus of EMI surveillance may be less strong, or the DAE diploma programmes where the presence of bilingualism may be more pronounced. A comparative institutional analysis of three streams of public, private and technical would chart the influence of the degree of surveillance on translanguaging sequential organisation.

Third, mode of data: Video recording of gaze and gesture and not student-student interaction during pair work. We thus over-represent teacher-led translanguaging. A taping of peer problem-

solving sessions may provide insights into the way translanguaging may work in horizontal knowledge co-construction, rather than vertical teaching.

Fourth, disciplinarity: The technical lexicon and visual-diagrammatic logic of the engineering field might pose specific requirements of translanguaging. To check the hypothesis that our pattern of sequencing is general in other fields or is engineering-specific, replication of this study in Pakistani medical colleges (anatomy, pathology) or social sciences (theory, critique) would establish that pattern of sequencing.
Fifth, longitudinal developmental question: The snapshot of the 14 weeks study is not able to show us the process of development of the competence of translanguaging in students in relation to four-year programmes. A longitudinal CA experiment that followed the same group of students through freshman, senior year may show whether students slowly internalise bilingual epistemic stance differentiation and eventually do conceptual work in English without Urdu scaffolding.
Last: Policy uptake: This research offers evidence on the interaction of policies, but does not offer policy implementation avenues. Future studies must use design-based research (DBR) in collaboration with the officials of HEC in order to prototype and test translanguaging-integrated EMI policy pilots.

5.4 Methodological Reflections: CA in the Contingency of Pakistan.

CA research in Pakistani universities was a challenging and informative experience. Based on the negotiations of access, it was necessary to maneuver through bureaucratic levels (ORIC, department chairs, faculty) that slowed down data collection by six months. Nonetheless, when allowed to, participants remained exceptionally reflexive regarding their own bilingual behaviors and tended to self-designate as problematic, during member checking, meta-awareness that provided valuable resources to the analysis.
The methodological innovation was needed to transcribe bilingual data. Urdu had no convention in standard Jefferson notation of retroflex consonants or breathy voice. We have made provisional additions to the CA toolkit in Indic languages (↑, hh). Studies of CA in future South Asia need to work out common protocols of bilingual transcription.
The ethical aspects involved in video recording of gender mixed engineering classes necessitated culturally sensitive procedures. Only female students agreed with the condition of working with video recordings that should be analysed by the female researcher and they might view video frames and determine their acceptability. Such model of participation consent should be formalized in Pakistani IRB principles.
Most importantly, the demand of CA toward participant orientation was politically effective. By providing transcript snippets to the officials of HEC they were unable to dismiss translanguaging as a lazy teaching since sequential evidence had revealed that students were initiating bilingual repair thus making it a right. This implies the possibility of CA being a potential advocacy research in language-policy competitions.

6. Conclusion: In the direction of a Legitimised Bilingual Pedagogy.

This paper proves that for the first time Pakistan engineering classrooms are already advanced translanguaging environments, in which bilingual practices are already systematically structured to achieve conceptual scaffolding, epistemic navigation, and formative assessment. In contrast to the monoglossic ideology of EMI used by HEC, translanguaging is not handled by the participants

as a compensatory deficiency but as a responsible pedagogical tool, also supported by the manifestations by the participants in their next-turns, not the interpretation of the researchers.

Sequential analysis shows that building of effective engineering knowledge in the Global South of Pakistan needs temporary and focused bilingual scaffolding to bridge the epistemic preparedness of students and English technical registers. The tendencies which we recognize as repair translanguaging, bilingual preface, differentiation of epistemic stance, and bilingual assessment are not unique interactive skills but common interactional competences, which faculty engineering has evolved tacitly by negotiating between conflicting linguistic policies.

The policy imperative is obvious: HEC has to legitimise what is already necessary pedagogically. Instead of punishing the practice of bilingualism, quality assurance systems need to accredit the translanguaging ability of instructors, which is their capacity to tune the use of language in response to the chronological contingencies of the construction of engineering knowledge. This means that instead of enforcement of EMI through surveillance, the pedagogical autonomy based on interactional evidence must be established.

We end with an extract to which we began. By teaching the concept of entropy in two languages, Dr. Tariq is not engaging in the abandonment of English-based education, but rather is instantiating the epistemic labour that is necessary to open it up. The Pakistani engineering students, who are the future constructors of infrastructures in the country, should have policies that address this labour as a legitimate, professional, and indispensible labour. The other option is the further hypocrisy of having two languages at the same time that is being practised and stigmatized, which impedes the depth of concepts and the integrity of the policies.

These micro-findings should be applied to macro-policy by future studies, which will apply design-based research to pilot translanguaging-based EMI models. At this juncture we can present the study as an empirical ground: we are not seeing the standards being lowered when it comes to legitimising bilingual pedagogies, but rather it is a question of matching the standards to the interactional realities of the ways in which engineering knowledge is actually constructed in the classrooms of Pakistan.

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