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Leveraging mutually shared knowledge through translanguaging in EMI classrooms: combining multimodal conversation analysis with interpretative phenomenological analysis

Abstract: Recent research has examined how teachers utilize translanguaging to tap into students' out-of-school knowledge and students' prior learnt content knowledge to scaffold students' learning of new content knowledge. This study addresses a research gap by examining how teachers can maximize the utilization of mutually shared knowledge, which is not accessible to individuals outside the classroom community, through translanguaging to consolidate students' content learning. The data is derived from a larger project conducted in Hong Kong secondary English-Medium-Instruction mathematics classrooms. Multimodal Conversation Analysis (MCA) is employed to analyse classroom interactions, triangulated by video-stimulated-recall interviews analysed with Interpretative Phenomenological Analysis (IPA). We argue that establishing a translanguaging space allows teachers to capitalize on the shared sociocultural knowledge intrinsic to classroom communities, which shapes content instruction and forges meaningful relationships with students. We also highlight the significance of combining MCA with IPA to gain a deeper understanding of specific translanguaging moments and the reasoning behind incorporating mutually shared sociocultural knowledge into classroom interactions, which cannot be attained solely through the description of interactional sequences.

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1 Introduction

In the field of applied linguistics, researchers have explored how teachers can mobilise diverse funds of knowledge in order to bridge the gap between students' prior knowledge and in-class learning for enhancing classroom participation and comprehension (e.g., Baynham 2006; van Lier 1996). Moll et al. (1992) coin the term "funds of knowledge" which comprises a wealth of cultural and cognitive resources that teachers can utilize to provide culturally responsive and effective teaching methods. By incorporating these funds of knowledge into the classroom, both teachers and students can foster a more inclusive environment and engage in authentic, real-world learning experiences.

On the other hand, English Medium Instruction (EMI) involves teaching and learning content subjects using English as a second language (L2) (Macaro 2018). This approach is prevalent in post-colonial regions like Hong Kong, where the current study is based, and is gaining popularity in Europe, as well as in South America which views English proficiency as a crucial step toward globalization and internationalization (Lasagabaster 2022; Macaro 2020; Wilkinson and Gabriels 2021). Recent studies on EMI classroom interaction have explored the effectiveness of translanguaging in enabling teachers and students to utilize diverse multilingual and multimodal resources to facilitate content teaching and learning, enhance students' metalinguistic awareness and foster a safe learning environment (e.g., Prada 2019; Sah and Li 2022; Tai 2023a). Translanguaging researchers (e.g., Li 2011, 2018; Mendoza 2023) have highlighted the importance of employing various multilingual, multimodal, and sociocultural resources to challenge the boundaries between so-called "named languages" and non-verbal communication cues, as these resources are all part of the meaning- and sense-making repertoire.

Previous research has shown how EMI teachers can utilize their shared repertoire with students to foster a positive classroom environment and enhance students' motivation in learning content subjects (e.g. Tai 2023a; Tai and Li 2020) However, there is a research gap in understanding how EMI teachers can maximize the use of mutually shared knowledge, exclusive to the classroom community, through translanguaging to strengthen students' content learning. This exclusive sociocultural knowledge refers to specific cultural and contextual understandings that are known and shared only within the teacher-student relationship, forming an integral part of the 'shared repertoires' (Wenger 1998) unique to that particular classroom community.

The study involves intensive observations of two EMI mathematics classrooms, with researchers collecting classroom video recordings and conducting video-stimulated recall interviews with the participating teachers. The classroom interaction data is analysed using Multimodal Conversation Analysis (MCA), while the video-stimulated recall interview data is analysed using Interpretative Phenomenological Analysis (IPA). A key theoretical contribution of this study is its conceptualization of translanguaging practices as a resource that helps shape a community

of practice for learning (Wenger 1998). This allows teachers to leverage the unique sociocultural knowledge within the classroom community. Methodologically, this study underscores the value of integrating MCA and IPA in understanding the mobilization of mutually shared knowledge facilitated through translanguaging during classroom interactions to promote student engagement and facilitate students' content learning. In order to address the research gap, this study aims to address the following research questions:

1. How do EMI Mathematics teachers create a translanguaging space for mobilizing the sociocultural knowledge that is unique to the classroom community?
2. How does the mobilisation of sociocultural knowledge promote student engagement and facilitate students' content learning?

2 Translanguaging

The Welsh-inspired term "translanguaging" was initially introduced to define the pedagogical practices of alternating between various input and output languages in bilingual classrooms (Williams 1994). Li (2018) further refined the idea of translanguaging as a practice for constructing knowledge, which entails transcending diverse linguistic structures and systems (including not just languages and dialects, but also styles, registers, and other language use variations) and various modalities (such as switching between speaking and writing, or coordinating gestures, body movements, facial expressions, and visual images). By highlighting the transformative aspects of translanguaging practices, Li (2011, 2018) introduced the concept of a "translanguaging space", where various multilingual, multimodal, and multisensory repertoires interact and generate new meanings. The idea of a translanguaging space differs from other conceptualizations of language such as 'code-switching', as it seeks to surpass the boundaries between spatial and other semiotic resources, considering spatial positioning and object display as semiotic and socially significant. Therefore, translanguaging encourages classroom participants to draw on their varied linguistic, multimodal, and multicultural resources to challenge the hierarchy of designated languages and enable students to actively participate in the creation of new knowledge and creative language practices.

Recent research has explored the development of translanguaging spaces in EMI classrooms. A study by Jakonen et al. (2018) examined how a student's translanguaging practices challenge the English-only norm in a junior secondary CLIL history classroom in Finland, and how they are perceived as 'language mixing' by other students. The analysis reveals that the student's translanguaging practices involve using a wide array of linguistic resources, combining English and Finnish vocabulary and grammar, and pronouncing English words with a distinct Finnish accent, resulting in a highly creative and hybrid linguistic form. Tai's (2024) study

redefined the concept of teacher contingency, which spontaneous creation of the teacher's utterances, rather than those planned beforehand. Tai argued that a teacher's adaptive response to unexpected outcomes during real-time interactions is a process of translanguaging. The study focuses on teacher contingency in creating a translanguaging space, which expands the EMI history teacher's options and agency in using diverse linguistic and multimodal resources to construct contingent actions.

Furthermore, in certain places (e.g., India and Pakistan), many students do not receive instruction in their L1s, as these languages are indigenous rather than the predominant national languages. For instance, in a recent translanguaging study conducted by Sah and Li (2022), the authors demonstrate that translanguaging practices involve switching between the dominant national languages (Hindi in India and Urdu in Pakistan) and English, despite the fact that these students have different L1s, like Panjabi in Pakistan. The authors argue that the teachers' and students' uncritical adoption of translanguaging practices reinforces the hierarchy of named languages by privileging national languages (e.g., Nepali) over indigenous languages for minoritized students (e.g., Newari). Similarly, a recent ethnographic study by Phyak et al. (2022) investigates how Nepalese EMI teachers challenge the monolingual EMI policy to encourage student participation in classroom interactions. The results show that teachers utilize translanguaging to oppose the monolingual EMI ideology while teaching English and content subjects, recognizing students' home languages as valuable resources for effective pedagogy in EMI classrooms. These studies highlight that the EMI teachers' ability to create a translanguaging space in EMI classrooms is largely influenced by their critical understanding of linguistic diversity and its impact on students' learning experiences.

While numerous studies have explored the creation of translanguaging spaces in EMI classrooms (e.g. Phyak et al. 2022; Tai 2024), there is a noticeable gap in research examining how translanguaging spaces can incorporate the sociocultural knowledge that is exclusive to the teacher-student relationship. In order to address the research gap, this study specifically explores how creating a translanguaging space can enable EMI mathematics teachers to leverage mutually shared knowledge, which is unavailable to those outside the classroom community, in order to enhance students' content learning.

3 The stance of conversation analysis regarding the role of shared knowledge

Conversation Analysis (CA), originating from ethnomethodology and sociology, examines how social order is collaboratively established within a social group through detailed analysis of interactions. By adopting an emic or participant-focused

approach, CA researchers analyse social interactions without preconceived notions about the significance of language or other semiotic resources like gestures and body posture (Hutchby and Wooffitt 1998). The primary goal is to explain conversation organization across different contexts, focusing on mechanisms rather than specific content (ten Have 1990).

When analysing social interactions, conversation analysts hesitate to rely on cultural context external to the conversations. First, they believe analysis should concentrate on the context that participants attend to in their interactions, rather than analysts' theoretical assumptions about significant contextual features (Schegloff 2007; Hauser 2011). Second, with countless external cultural, social, or personal factors potentially relevant to any interaction, analysts prefer to document the observable resources speakers use to construct their actions. Thus, participants' feelings about the interactions are not directly relevant to CA analysis, as it does not aim to document speakers' concerns known only to themselves (Antaki 2012). Finally, conversation analysts commit to treating participants as knowledgeable social agents who actively display their orientation to relevant contexts (Hutchby and Wooffitt 1998). Hence, researchers should adopt an emic perspective to show, through participants' interactional practices, if and how specific sociocultural knowledge is relevant to their social interactions.

There are limited research studies in CA that have shown how participants utilize mutually shared knowledge to construct their turns in everyday life social interactions (e.g. Deppermann 2018; Gordon 2003). By "mutually shared knowledge", we refer to the unique understanding and information known by individuals within the same community. Exclusive sociocultural knowledge implies that there are specific cultural and contextual understandings that are known and shared only between speakers in the social interaction. This mutually shared knowledge forms an integral part of the legitimate "shared repertoires" (Wenger 1998) which belong to the members of this particular community. The concept of 'Community of Practice' (Lave and Wenger 1991; Wenger 1998) describes a group of individuals with shared objectives and interests who collaborate and participate in collective activities. These community members develop a shared repertoire of resources, which includes their experiences, tools, methods, unique linguistic expressions, and artifacts, to support their process of creating meaning (Evnitskaya and Morton 2011). Gordon (2003) investigated how participants in family interactions draw on shared past experiences to shape their arguments. The analysis reveals that family interactions serve as discursive spaces, bringing together multiple family histories, life experiences, and knowledge bases, allowing interlocutors to identify commonalities or differences with other family members. On the other hand, Deppermann (2018) introduced the concept of "interactional histories", which pertains to the previously shared interactional experiences of participants. The analytical focus lies on these prior shared experiences, which

serve as common ground between interlocutors. In an analysis of driving school lessons, Deppermann examined the change in turn design between instructors and students over time. The findings indicate that as participants develop their shared interactive histories, they reduce the need for explicitness and verbal precision typically found in initial instructions. This also reflects students' acquisition of driving skills and the growing shared experience between instructor and student, which contribute to changes in turn-taking patterns.

The aforementioned studies utilize CA exclusively to examine how participants employ shared knowledge and past experiences in accomplishing their communicative goals. However, the analytical perspectives of CA can become challenging when participants belong to cultural or linguistic communities that differ from those of the conversation analyst (de Kok 2008). To address an analyst's lack of sociocultural knowledge, de Kok (2008) suggested using interviews, especially those where the interviewer is not part of the participants' sociocultural community, in order to remedy an analyst's lack of sociocultural knowledge. This methodological approach can reduce the risk of invoking context that may appear relevant analytically but may not align with the participants' perspectives.

In this study, we propose that researchers need to combine CA with participants' metalanguage data (i.e., their commentary on language use) in order to better understand how teachers and students draw on shared sociocultural knowledge to create a translanguaging space, fostering a more engaging educational experience for students.

4 Researching translanguaging: combining multimodal conversation analysis with interpretative phenomenological analysis

Tai (2023b) proposed combining MCA and IPA in translanguaging studies, allowing researchers to investigate the construction of translanguaging practices in multilingual classrooms and how classroom participants interpret their own translanguaging practices during specific moments of classroom interaction. As argued before, translanguaging practices are complex, with various sociocultural factors, including personal history, identity, and beliefs, influencing participants' translanguaging practices (Li 2011). MCA cannot reveal how participants bring various dimensions of personal history, ideologies and beliefs etc. to create the translanguaging spaces in classroom interactions (Tai 2023b). These sociocultural factors may not emerge from the MCA analysis directly, but they can be explored through using interviews and/or ethnographic approaches. Therefore, employing this

methodological combination enables a deeper understanding of how and why translanguaging practices are constructed by participants in particular moments of classroom interactions, which cannot be achieved through a mere description of the interactional sequence.

While there are debates surrounding the incorporation of ethnographic information into MCA analyses (e.g., Antaki 2012; Hauser 2011; Markee 2008), Seedhouse (2004) contended that it is still feasible to combine MCA with an ethnographic approach when studying classroom interactions. Ford (2012: 511) further noted that for research projects not solely focused on CA, but using CA as one of the methods, participants' self-reports serve as valuable resources for understanding their concerns, ideologies, and potential connections between retrospective recollections and real-time interactions. In the context of research topics like translanguaging practices, obtaining ethnographic information is essential to complement the MCA analysis of classroom interactions (Tai 2023b). Seedhouse proposed that an initial MCA analysis examining how participants perform actions in interactions can be followed by an ethnographic analysis exploring why they engage in such actions. Consequently, Seedhouse (2004) asserted that while combining MCA and ethnographic information allows researchers to connect macro-level contextual and social structures with micro-level linguistic practices, any analytical claims regarding the interactions must be grounded in the participants' orientations, as evidenced by the details of their conversation. In other words, external/contextual factors like culture are relevant to MCA analysis only if they are shown to be present in the details of the interaction.

The combination of MCA and IPA is inspired by Li's (2011) concept of moment analysis. This method, which utilizes the analytical strategies of MCA and IPA, concentrates on how language users mobilise diverse linguistic and non-linguistic semiotic systems during specific moments of social interaction. Li (2011) maintained that it is vital to comprehend what triggers a distinct social action at a particular moment in the interaction and the outcome of that action. To conduct this analysis, researchers must gather various types of data. Li (2011) recommended that researchers collect both observational data and audio/video recordings of natural interactions, as well as metalanguage data (i.e., the speakers' commentary on their language use). The collection of metalanguage data allows researchers to gain a deeper understanding of how individuals attempt to interpret their experiences.

In order to understand how speakers interpret and make sense of their own translanguaging practices, Tai (2023b) argued that MCA findings can be triangulated with the video-stimulated-recall-interview data which can be analysed using IPA. IPA is a qualitative method developed in the field of psychology to study personal lived experiences (Smith 1996). Smith and Osborn (2008) explain that IPA emphasizes a thorough exploration of individual experiences and how people interpret and

comprehend their own experiences. The underlying premise of this methodology is that individuals are continuously involved in the world and persistently contemplate their experiences to understand them (Smith et al. 2013). Therefore, it can be argued that IPA can allow researchers to investigate how classroom participants make sense of their social practices at particular moments in the interaction. IPA follows a dual interpretation process called "double hermeneutic". This requires researchers to try to make sense of the participants trying to make sense of their world (Smith et al. 2013). This approach enables an emic understanding of the teacher's personal experience, while also integrating theoretical concepts from external sources to explain psychological phenomena, adopting an etic perspective. This dual interpretation process enhances the analysis of participants' lived experiences. To incorporate a critical analysis of social interaction, a microanalysis of the talk should initially be conducted, which is then supplemented by triangulating it with an IPA analysis of the video-stimulated-recall-interview data. It is important to note that this process maintains the analytical rigour of MCA without compromising its integrity.

5 Mobilising shared knowledge in classroom interactions

Researchers have examined ways for teachers to connect students' prior knowledge and experiences with the academic content they learn in school, in order to enhance their learning experience. Evnitskaya and Morton (2011) analysed the use of linguistic and other semiotic tools by teachers and students to negotiate meaning and establish their identities during a secondary biology laboratory session in Spain, taught through Content and Language Integrated Learning. EMI and CLIL classrooms exhibit commonalities, as both approaches maintain that employing an L2 for content instruction offers genuine and significant contexts that facilitate L2 learning and acquisition (Snow et al. 1989). CLIL, frequently utilized in Europe, is characterized as an educational strategy that incorporates diverse language-supportive methods, emphasizing both language and content (Coyle et al. 2010). Evnitskaya and Morton demonstrated how participants employ everyday language and various modes of communication (such as physical objects and body language) to comprehend scientific concepts. Through collaborative participation in scientific experiments, they engage with multiple discourses and adopt context-specific identities as observers, experts, reporters, and co-creators of scientific assertions. In a different study, Escobar Urmeneta and Evnitskaya (2014) demonstrated how a CLIL teacher leverages shared knowledge to support students' scientific comprehension in a secondary CLIL science classroom. They discovered that the teacher employs both scientific and colloquial examples, as well as introduces everyday objects, to activate the common knowledge between the teacher and students. Similarly, Tai and Li (2020) examined

how a teacher incorporates external knowledge into a HK EMI mathematics classroom. They contend that using students' familiar linguistic and multimodal resources allows the teacher to blend their everyday experiences into the learning environment, transforming the classroom into a lived experience. In a recent study, Tai (2023a) investigated how an EMI Western History teacher connects academic knowledge that students have learnt from other content subjects to facilitate their learning of new academic knowledge. The study suggests that a translanguaging classroom space can be established to transcend disciplinary boundaries, enhance students' comprehension of subject-specific concepts, and broaden their perspectives as they recognize the importance of diverse academic knowledge in acquiring new content knowledge. This argument aligns with Song's (2024) findings, which highlight the role of translanguaging in offering valuable opportunities for trans-knowledging which involves teachers and students to mobilise various discipline-specific knowledge to create new meanings in EMI contexts. Bozbiyik and Morton (2022) illustrated how an EMI chemistry lecturer incorporated outside knowledge and simultaneously employed various linguistic and multimodal resources to verify, strengthen, and expand his students' understanding of the current chemistry topic, potentially aiming to promote student engagement.

Existing research has shown that teachers can utilize their shared repertoire with students by incorporating students' prior life experiences into the classroom (e.g., Evnitskaya and Morton 2011; Lin and Leung 2024; Tai and Li 2020) and engaging in cross-curricular connections (Bozbiyik and Morton 2022; Tai 2023a) to enhance students' learning of content subjects. Nonetheless, there is still a research gap concerning how teachers can draw upon the mutually shared knowledge with students to create engaging learning experiences in classroom interactions. As previously mentioned in Section 3, the knowledge that is mutually shared between the teacher and students encompasses nuanced insights, experiences, and perspectives unique to the classroom community, which may not be readily accessible or understood outside of that context. This knowledge can potentially serve as a valuable and specialized resource, enabling the teacher to enhance instructional strategies, foster meaningful connections, and create a supportive learning environment for the students. In this study, we contend that the teacher's use of sociocultural knowledge unique to the teacher-student relationship, facilitated through translanguaging, serves as a critical factor in promoting student engagement.

6 EMI in Hong Kong

While medium-of-instruction policies in HK are generally established for primary and university education, secondary level policies have undergone significant changes (Bauer 2016; Bolton and Moody 2024; Poon 2010). HK secondary schools have experienced three main developmental stages concerning medium-of-instruction

policies: (1) the laissez-faire policy before 1994; (2) the mandatory Chinese-Medium-Instruction (CMI) policy from 1998 to 2010, which permitted 114 secondary schools to utilize EMI for content subjects while the remaining 307 schools were required to use CMI; and (3) the fine-tuning medium-of-instruction policy since 2010. The fine-tuning policy partly addresses parental preferences for EMI education for their children. Under this policy, secondary schools can offer EMI classes, partial-English-medium classes (i.e., one or two subjects conducted in EMI), and/or CMI classes. CMI schools can choose their medium-of-instruction for content subjects if they meet specific criteria (Education Bureau 2009). Consequently, many secondary schools now offer EMI classes, with approximately 30 % using EMI for all grade levels and around 40 % adopting EMI for at least one content subject.

Research studies (e.g., Chan 2013, 2014) have shown that the fine-tuning policy has its limitations. Although the government has established specific criteria for offering EMI classes, simply placing students in EMI classes does not guarantee automatic learning. Therefore, this study aims to illustrate how adopting a trans-languaging approach at the local level can address the challenges currently faced by teachers and students in EMI teaching and learning.

7 Data and methodology

7.1 Participating schools and students

The principals of Schools A and B granted the first and second authors permission to carry out ethnographic data collection at their schools, which could provide new perspectives on EMI classroom interactions. According to the language policies of School A and School B, teachers are required to conduct their classes in English. School A is a prestigious EMI secondary school in the New Territories, offering EMI education from year 7 to year 12 (except for Chinese Language and Literature, liberal studies, and Mandarin classes). While the school's mission statement aims to develop students into bi/multilingual individuals, the language policy highlights the importance of using English for communication on campus. This policy seeks to foster a robust English learning environment for all students. During a two-week classroom observation, the first author observed a year 10 class consisting of 30 students, classified as an elite class based on the school's internal examination results. All students spoke Cantonese as their L1 and had received at least six years of primary education with Cantonese as the medium of instruction and English as an L2. A total of eight 40-min lessons were observed and video-recorded.

School B is a government-subsidized EMI secondary school located in the Yuen Long district. According to the school's language policy document, the school employs EMI for most subjects (excluding Chinese Language and Literature and

Putonghua), and teachers are prohibited from using L1 Cantonese during instruction. However, this restriction does not apply to students, who are free to speak Cantonese or Putonghua during and after classes. The campus has a multilingual atmosphere, characterized by student conversations in Cantonese and Putonghua, and interactions between students and teachers in English during class and in Cantonese afterwards. Additionally, many cross-boundary students live in mainland China but attend school in Hong Kong. In the observed class, most students received CMI primary education and began junior secondary education in EMI. The class has 32 students in total, including six cross-boundary students who are not proficient in Cantonese and English. The abrupt shift in the medium of instruction poses a challenge for students, especially those with lower English proficiency, as EMI courses demand a high level of English and academic language proficiency. The second author collected video-recorded data from classroom observations over three weeks, accompanied by fieldnotes for each of the 12 lessons observed.

7.2 Participating teachers

In this research, two EMI teachers were chosen as participants through convenient sampling. This method was used because it provided easy access to teachers who were interested in the study and willing to investigate the concept of translanguaging. Teacher A (TA) has a minimum of eight years' experience teaching mathematics in English and currently holds the position of Head of the Mathematics Department in School A. He is a native Cantonese speaker who attended an EMI school for his secondary and university education. English is his second language, and he possesses a limited proficiency in Mandarin/Putonghua. During his undergraduate studies, he occasionally taught drama at various Hong Kong secondary schools. He did not undergo any specific EMI teacher training while pursuing his education degree.

Teacher B (TB) is an educator with over nine years of experience teaching mathematics at School B. He is a native Cantonese speaker who attended EMI schools for both his secondary and university education. Additionally, TB gained valuable learning experience through his postgraduate study in Content and Language Integrated Learning (CLIL) specialism in Hong Kong. As a result, TB possesses significant teaching experience, professional knowledge, and pedagogical skills.

7.3 Data collection

This study followed the guidelines established by The University of Hong Kong Research Ethics Committee. Consent forms were provided to participants in both Chinese and English. The first and second authors explained the different aspects of the project to school principals, participating teachers, and students in person, including

its objectives, the researchers' responsibilities, and the procedures for data collection and storage. Students who did not consent to participate in the study were asked to sit in areas where the video camera would not capture their faces. A total of two semi-structured interviews were carried out with teachers A and B in order to understand their perceptions of best practices and their attitudes towards using multiple languages in the EMI mathematics classrooms. During classroom observations, a total of eight 40-min lessons taught by TA at school A and a total of twelve 40-min lessons taught by TB at school B were observed and video-recorded. One video camera was set up in classrooms in order to capture the teachers' and students' behaviour simultaneously. Both TA and TB attended a 1-h video-stimulated-recall-interview which enables researchers to understand their pedagogical practices and their interpretations of their practices. Before conducting the interviews, video-clips which reveal salient features of teachers' translanguaging practices were chosen by the first author as the stimulus. The teachers were invited to watch the selected video-clips and explain why they employed translanguaging practices in particular classroom moments. This provides the teachers with a chance to reflect on their own pedagogical practices and verify certain things that are not clear from the observation alone. In the analysis, the interview data will be discussed after the analysis of each classroom interactional extract.

7.4 Combining MCA with IPA

Multimodal CA is deployed to analyse the classroom interaction data. The multimodal CA transcriptions in Extracts 1a, 1b, 2a and 2b include verbal transcriptions in both Cantonese and English, as well as multimodal actions. The identifications of the translanguaging instances are not in any sense defined a priori. This is because the instances are derived from the examination of the classroom corpus. Moreover, screenshots from the video recordings were included to reveal multimodal interactions in the EMI lessons. The data are transcribed using Jefferson's (2004) and Mondada's (2018) transcription conventions (see Appendix).

IPA is used to analyse the video-stimulated-recall-interview data and complement the MCA analysis (Tai 2023b). We conducted the IPA analysis together and followed the analytical stages suggested by Smith et al. (2013), moving from a descriptive level to a more interpretative level. In order to enhance interpretative validity, iterative coding with constant comparison was conducted. This process involves the researcher constantly checking our sense-making against what the participating teachers have actually said in the interviews. The IPA analysis is presented in a table with three columns in order to help readers navigate how the researcher makes sense of the teachers trying to make sense of their teaching. From left to right, the first column presents the video-stimulated-recall interview transcripts. The second column reveals the teachers' perspectives on their pedagogical practices. Lastly, the third column illustrates the researcher's interpretations of the

teachers' perspectives, which aligns with IPA's interpretation process. The double hermeneutic perspective is apparent in interpretive statements such as "it can be argued," "may be understood as," "may explain why," and so forth. To maintain transparency, we have emphasized these interpretive statements throughout the analysis (Ai et al. 2022).

8 Analysis

For reporting the findings, we included representative extracts instead of presenting every transcribed interaction. These extracts exemplify instances of interaction and are interconnected to depict typical occurrences of mobilising mutually shared knowledge through translanguaging in EMI classrooms (ten Have 1990). The objective of MCA analysis is to identify the interactional phenomenon in social interactions, rather than merely justifying the most representative extracts (ten Have 1990). As such, if the chosen extracts can address the research questions and reveal the pertinent 'orderliness' through their representative nature, it can be argued that the representativeness is adequate, and the research findings are reliable to a significant extent. In the data collection, 2 cases were identified which showcase how TA (Extract 1) and TB (Extract 2) create a translanguaging space for mobilising mutually shared knowledge in order to (1) introduce the content topic to students (Extract 1) and (2) facilitate playful talk in classroom interaction (Extract 2). The analysed extracts are triangulated with video-stimulated-recall-interviews to offer additional insights into the teachers' rationales for incorporating mutually shared knowledge into classroom interactions (Tai 2023b).

8.1 Extracts 1a and 1b: incorporating mutually shared knowledge to introduce content topic to students

Extracts 1a and 1b demonstrate the adept use of varied linguistic and multimodal resources by TA to incorporate shared knowledge between himself and his students when introducing a new mathematical topic. Prior to Extract 1a, TA prompted the students to move on to a new chapter focusing on 'variations,' which was a fresh topic for them to explore. He instructed the students to turn to a specific page in their mathematics textbook and displayed the corresponding page titled "basic concepts of variation" on the projector. In line 1, TA references an Instagram post made by one of the students, marking the beginning of introducing the new topic. In this extract, TA brings up the post, causing laughter as it is inferred that the post was made by Student 15 (S15). Despite some students being unaware of the post's content, TA continues to explore it, leading to a discussion about a mathematical concept. TA subtly identifies S15 as the post's author, provoking more laughter.

Extract 1a:

```
01 TA: +okay (0.7) 啊琴日呢 (0.3) 睇 IG 呢見到有同學問呢
                ((tr. so yesterday))
                            ((tr. I saw a student asking a question on Instagram))
        +TA directs his gaze to the ceiling
02 (1.1)
03 TA: 啊點解+原本個 area 呢
        ((tr. how come the original area))
            +TA looks at S15
04 Ss: +hahahahaha
        +Ss look at S15
        +TA smiling
05 (0.3)
06 S?: 好 gag 呀
        ((tr. so funny))
07 (0.2)
08 TA: +個 area 越大個速度越慢下嘛=
        ((tr. when the area gets larger, the speed will gradually decrease))
        +TA looks at S15
09 S15: =是啊=
         ((tr. yes))
10 TA: =即係
        ((tr. so))
11 (0.2)
12 S13: +係唔係 IG 嗰度
        ((tr. is it on Instagram?))
          +TA looks at S13
13 (0.2)
14 TA: IG (.) 我唔講邊個啦
                ((tr. I am not going to name the person))
15 (0.2)
16 Ss: hahahaha
17 (0.2)
18 S13: 你望住 (0.2) 你望住緊佢
        ((tr. you are staring at)) ((tr. you are staring at him))
19 (0.3)
20 TA: +我唔講邊個啦 (.) 是啦=
        ((tr. I am not going to name the person (.) right))
          +TA directs his gaze to S15 and moves his body, facing S15 #1
```

Figure #1

```
21 Ss:=hahahaha
22 (0.3)
23 TA: so who (0.5) who is he lei=
24 S16: +嗰個答 (.) 嗰個答案係啱㗎喎
         ((tr. the answer)) ((tr. the answer is actually correct))
         +TA looks at S16
25 (0.5)
26 TA: 啱唔啱呀
       ((tr. is it correct?))
27 (0.2)
28 S16: 如果我答 (0.3) 我覺得佢答得好啱
         ((tr. If l have to answer this question, I think he answers it perfectly))
29 (0.5)
30 TA: +嗰個答案係咩呀
        +TA turns to the BB
31 +(0.4)
    +TA writes 'Q' on the BB
32 T: q +equal to what (0.2) (NAME-S15)
         +TA turns his body and gazes at S15
33 (0.3)
34 S15: v times a
35 (0.4)
36 TA: +v times a er v times a
```

+T writes '=V&A' on BB #2

Figure #2

```
37 (0.2)
38 TA: a is the area +cross-section area
                +TA turns his body to students
39 (0.4)
40 S15: 唔係我咁啱識啫
         ((tr. oh not really, I know this by chance))
41 (0.8)
42 TA: 哦 (0.3) +咁啱 (0.2) 咁啱呀 (NAME-S15) 識啫
   ((tr. oh))      ((tr. by chance))   ((tr. S15 only knows this coincidentally))
              +TA points at S15
43 (0.3)
44 TA: +唔係呀 (NAME-S15) 嚟嘅
      ((tr. so it's not S15))
      +TA points at S13
45 (0.3)
```

In lines 1–3, TA uses Cantonese to mention an Instagram post he saw the previous day, which was posted by one of the students in the class. In line 3, TA specifically describes the question asked by the student on Instagram, "點解+原本個area呢" (why the original area). Notably, TA looks at S15 while uttering this line, which elicits laughter from the class in line 4. TA also smiles, indicating a light-hearted moment and implying that S15 is the author of the Instagram post. In line 5, an unidentified student comments, "好gag呀" (so funny), highlighting the humorous aspect of TA's attempt to share the content of the Instagram post published by S15.

In line 8, TA switches the focus of the talk and continues explaining, "+個area 越大個速度越慢下嘛" (When the area gets larger, the speed will gradually decrease). TA looks at S15, possibly seeking confirmation from them, and it becomes evident that S15 affirms TA's explanation. Student 13 (S13) then asks about the Instagram post in line 12, "+係唔係IG嗰度" (Is it on Instagram?), indicating that the content of the post is not universally known among all the students in the class.

Notably, TA responds in line 14, "我唔講邊個啦" (I am not going to name the person on Instagram). Despite being challenged again by S13, who points out, "你望住你望住緊佢" (You are staring at him), TA reiterates in line 20, "+我唔講邊個啦是啦" (I am not going to name the person, right), while simultaneously directing his gaze towards S15 and adjusting his body position to face S15. Following this, the students respond with laughter in line 21, acknowledging the humorous situation as students in the class realise that S15 is the author of the Instagram post.

In line 24, student 16 (S16) redirects the conversation back to the post's content, asking if the answer is correct. Here, it can be assumed that the content of S15's question is related to a mathematical question, and such knowledge is mutually shared with some students in the class, such as S16. TA asks for the answer in line 26, "啱唔啱呀" (Is it correct?). S16 continues in line 28, expressing his belief that S15's answer is indeed correct.

In line 30, TA asks, "+嗰個答案係咩呀" (What is the answer?), turning the students' attention towards the blackboard. TA writes 'Q' on the blackboard in line 31 and asks, "q +equal to what (0.2) (NAME-S15)," while turning his body and gazing at S15 (line 33). Interestingly, TA explicitly mentions S15's name, abandoning the anonymity of the student who published the Instagram post. S15 responds in line 35, saying "v times a," and TA repeats the response in line 37, saying "v times a" and writes ' = V&A' on the blackboard (figure #2). TA subsequently points out that 'a' refers to the cross-section area (line 38).

It is possible that TA would continue with his turn to explain the other variables 'Q' and 'V'. However, S15 initiates a turn that redirects the topic by stating in line 40, "唔係我咁啱識啫" (Oh, not really, I know this by chance). This leads to TA engaging in playful talk with S15, switching back to Cantonese and acknowledging S15's utterance in line 42, saying "哦 (0.3) +咁啱 (0.2) 咁啱呀 (NAME-S15) 識啫" (S15 only knows this coincidentally) while pointing at S15. In line 44, TA clarifies, "+唔係呀 (NAME-S15) 嚟嘅" (So it's not S15), using ironic jokes about the Instagram post not being composed by S15.

In this extract, TA skilfully employs different languages (Cantonese and English) and nonverbal cues to foster a playful classroom atmosphere while leveraging the mutually shared knowledge of a specific Instagram post by S15. By connecting this post to the main topic of variation in this lesson, TA introduces a mathematical equation (Q = V&A) to the class. Towards the end of the interaction (lines 40–44), it is evident that the teacher engages in playful talk with the students (Tai and Li 2021). This playful interaction potentially helps the teacher maintain a positive relationship with S15, demonstrating the relational and rapport-building work that goes beyond the pedagogical function of introducing the topic. Extract 1b, occurring two minutes

later, delves deeper into this connection, highlighting the importance of the shared knowledge among the students.

Extract 1b:

```
76 TA: +anyway these +er
          +TA points at Q on the BB
                        +TA looks at S15
77 (0.8)
78 TA: so the +$area$
                  +TA underlines 'area' on the BB
79 (1.2)
80 TA: so if the +area increases okay? so what +is q
                  +TA draws an arrow going upward below A #3
                                              +TA points at Q on the BB,
                                              behind TA #4
```


Figure #3

Figure #4

```
81 (1.1)
82 S17: er °constant°
83 (1.0)
84 TA: what?
85 (1.1)
86 S17: °[constant]°
87 S13:    [你又知嘅?]
88 (0.2)
89 TA: constant okay? +it's a +constant (0.6) +it's a constant
```

```
                                 +TA turns to BB
                                         +TA draws an arrow going upward below Q
                                                   +TA writes 'constant' below
                                                   the arrow
90 (0.2)
91 TA: er that means (0.4) a number that +remains
                                            +TA double underlines 'constant'
                                            on the BB #5
```


Figure #5

```
92 (0.6)
93 TA: unchanged
94 (0.3)
95 TA: okay?
96 (0.4)
97 TA: +不變嘅呢個數字 okay?
          ((tr. this number will remain unchanged))
          +TA points at 'constant' on the BB
98 (0.3)
99 TA: so +if +this number +remains unchanged
              +TA points at 'constant' on the BB
                  +TA points at 'Q' on the BB
                      +TA points at 'constant' on the BB
100 (0.4)
101 TA: but +area +increases (0.3) so what +happen to this v
              +T points at 'A' on the BB
                  +TA extends his index finger up and moves his finger upward #6
                      +TA draws an arrow going
                      downward above 'v' on the BB
                      #7
102 (.)
```

Figure #6

Figure #7

```
103 TA: +v is the speed right?
         +TA turns to S15
104 (0.3)
105 TA: the speed of +the (0.4) the (flud)=
                     +TA writes 'speed' above the arrow going downward #8
```

106 TA: =係嗎? (0.3) 係啦有同學就問嘅琴日 (0.2) +就唔講啦 (0.2) 唔開名啊
　　　　((tr. right?))　　((tr. right so yesterday a student asked))
　　　　　　　　　　　　　　　　　　　　((tr. I won't say it)) ((tr. not going
　　　　　　　　　　　　　　　　　　　　　　　　　　to disclose
　　　　　　　　　　　　　　　　　　　　　　　　　　the name))
　　　　　　　　　　　　　　　　　　+TA waves his RH

Figure #8

107 (0.3)

108 TA: +咁某同學就問啦 (0.2) +點解個 cross a- area 呢?+=

((tr. so a student asked))   ((tr. how come that cross area))

+TA raises up his RH, palm facing students, fingers extended, pointing at S15 #9

+TA raises up his RH, palm facing students, fingers
extended, pointing at S15

+TA moves his RH upward & downward concurrently→

→+

109 TA: =cross section area

Figure #9

110 (0.3)

111 TA: +increases 個 speed 就會+decrease 嘅呢? 咁樣=

((tr. when the cross-section area increases, the speed will decrease))

+T extends his index finger up and moves his finger upward #10

+T extends his index finger, facing downward, and
moves his finger downward #11

Figure #10

Figure #11

```
112 TA: =+since (0.3) something keep +constant
           +TA points at the equation on the BB, behind T
                                          +TA points at 'constant' on the BB
113 (0.5)

114 TA: that's why +this one +increase this one will +decrease
                   +TA points at 'A' on the BB
                              +TA extends his index finger up and moves his finger
                              upward

                                                  +TA extends his
                                                  index finger,
                                                  facing downward,
                                                  and moves his
                                                  finger downward
115 (0.8)
116 TA: okay?
117 (0.2)
118 TA: +use your common sense to think about that=
           +T flips his RH and RH palms faces upward
119 Ss: =hahahaha=
120 TA: =$okay?$=
121 Ss: =hahahaha=
122 S13: =+你冇 common sense 喎
               ((tr. you don't have common sense))
            +S13 turns her head and her gaze to S15
123 (0.3)
124 TA: +I (.) I (0.4) 我我唔係話個+同學+冇 common sense (.) +okay?=
                  ((tr. I, I am not implying that student has no common sense))
            +TA holds his RH up, RH palm facing students
                              +TA holds his RH arm horizontally #12
                                      +TA drops his RH arm to his waist level
```

and leans his body slightly forward #13
                                                        +TA stands
                                                        straight

Figure #12

Figure #13

```
125 TA: =但係 (0.5) +something that +you are going to learn using
                    +TA rotates his RH
                                        +TA points at the screen and shakes his
                                        index finger repeatedly→
126 (0.2)
127 TA: er+
        →+
128 +(0.8)
    +TA walks closer to the screen
129 TA: basic concepts about variation
130 (0.3)
131 TA: something +increase then something +decrease (0.8) okay?
                  +TA extends his index finger up, above his head, and moves his
                  finger upward
                                        +TA extends his index finger,
                                        facing downward, and moves his
                                        finger downward
```

In lines 76–78, the TA links the concept of 'area' to the variable 'Q' on the blackboard. TA invites comments on what 'Q' represents when the area increases. Simultaneously, TA draws an upward arrow below 'A' to show an increase in its value

(Figure #3). S17 responds with "constant," indicating his understanding (lines 82 and 86). However, S13 briefly interrupts to question S17's knowledge (line 87). TA confirms that 'constant' is the correct answer and explains its meaning on the blackboard, emphasizing that 'Q' means a number that remains unchanged. It is noted that TA draws an upward arrow below the variable 'Q' and writes 'constant' below the arrow to indicate that 'Q' means 'constant'. TA clarifies this further in English in line 97 and switches to Cantonese for explanation.

In lines 99–101, TA poses a new question, asking students to consider what happens to 'V' when the area increases (line 101). TA points at 'A' on the blackboard to indicate the increase (Figure #6) and draws a downward arrow above 'V' (Figure #7), suggesting that its value will decrease. In line 103, TA clarifies that 'V' represents the speed of the fluid and writes 'speed' on the blackboard above the arrow (Figure #8).

To facilitate understanding, TA switches to Cantonese for the mathematical explanation, acknowledging a student's question on Instagram without disclosing his name. Interestingly, TA points at S15 while saying '咁某同學就問啦' (so a student asked), indirectly implying that S15 is the one who posed the question on Instagram (line 108). TA recalls the question about why the cross-sectional area increases and the speed decreases (lines 106–109). After using Cantonese to describe the question (lines 108–111), TA switches back to English and points at the equation on the blackboard (line 112) to explain the equation, emphasizing the concept of 'constant' as something that remains unchanged. TA concludes that when one variable increases, the other variable decreases (line 114), using deictic gestures to indicate the relationship between the variables (Figures #10 and #11).

TA initiates an 'okay' token to check understanding and encourages students to use their "common sense" to grasp the concept (line 118). This elicits laughter, and S13 jokingly points out that TA is implying that S15 lacks common sense (line 122). TA clarifies in Cantonese that this is not his intention (line 124). TA then connects S15's Instagram post with the mathematical topic, explaining that students will learn about basic concepts of variation. In lines 125–129, TA switches back to English, explaining that students will learn the "basic concepts about variation" (line 129). TA summarizes the concept, stating that when something increases, something else decreases, using the same deictic gestures to illustrate the concept (line 131).

In Extract 1b, it is evident that TA's utilization of S15's question from Instagram demonstrates a strategic approach to introducing the lesson's objective, which is to teach the fundamental concepts of variations. By incorporating S15's question, TA seizes the opportunity to connect the students' existing knowledge with the specific mathematical topic at hand. This deliberate choice serves to engage the students and establish relevance right from the beginning. Throughout this process, TA seamlessly switches between English and Cantonese, and mobilises different multimodal resources, including pointing at the blackboard, gesturing with their finger, and drawing arrows, to create a translanguaging space in order to facilitate students'

understanding of the content knowledge. During the video-stimulated recall interview, TA comments on his rationale for mobilizing mutually shared knowledge to introduce the content topic to students (Table 1).

Table 1: Video-stimulated-recall-interview (Extract 1).

Video stimulated recall interview Excerpts	Teacher's perspectives	Analyst's interpretations of the teacher's perspectives
01 K: 啊咁你講下啦咁 ((tr. So can you describe what happen in the interaction?)) 02 T: haha 呢一堂甘喎,咁喐本來可以有第二個方法介紹 variation ((tr. So originally there is another way of introducing 'variation')) 03 K: 係囉係囉 ((tr. Yes yes))		
04 T: 然後點知咁岩比我碌到佢哋個IG 就見到 haha 有同學就講起呢樣野,之後我就發現,我就知道呢個concept就係一樣嘅,就係variation,所以就利用呢件事嚟去帶入呢個 variation 等佢哋會更加感興趣囉,即係一講到同自己同學有關嘅時候haha 係啦,就係啦,本來其實,即係,個學科嘅知識係唔重要嘅,但係關係個同學事,咁佢哋就會有興趣聽究竟發生咩事啦咁	The teacher came across an Instagram post by chance and realised that it was related to the mathematical topic that students would be learning in class.	
((tr. Then, by chance, when I was scrolling through Instagram, I came across a post about it. Haha. There was a student discussing this topic, and that's when I realized that the concept was the same: variation. So, I used this opportunity to introduce the concept of variation to them, hoping to pique their interest. It's always more engaging when it's related to themselves and their classmates, right? Well, initially, the subject matter itself isn't important, but when it relates to their classmates, they become curious about what's happening.))	The teacher understands that relating the subject matter to the students and their classmates can enhance engagement and curiosity.	

Table 1: (continued)

Video stimulated recall interview Excerpts	Teacher's perspectives	Analyst's interpretations of the teacher's perspectives
05 K: um hm 咁你有冇留意,你係不斷咁指住嗰個S15 ((tr. Right so did you notice that you kept pointing at S15))		This discovery led the teacher to recognize that the concept being discussed was variation.
06 T: 有啊有啊 ((tr. Yes yes)) 07 K: 即係你一路講嘅時候一路指住佢 ((tr.so you were pointing at him while you were speaking)) 08 T: 有 ((tr. Yes)) 09 K: 但係又話唔開名啊 ((tr. But on the other hand, you mentioned the need to maintain the student's anonymity.))		The teacher recognizes the value of creating connections between the subject matter and the students' personal experiences.
10 T: 係呀 ((tr. Yes)) 11 K: 你係想create 緊啲,也嘢效果啊 ((tr. So what pedagogical goal are you trying to achieve here?))		The researcher is interested to understand why TA aims to engage S15 in the classroom interaction.
12 T: hahaha 開心啲囉等佢嚟,學呢樣野嘅時候,我知道啊 S15 玩得呀嘛 ((tr. Hahaha, I want the students to have a joyful learning experience with the new mathematical topic. Additionally, I am aware that S15 has a playful nature, and he wouldn't mind if I engage with him in a light-hearted manner.))	The teacher is aware that S15 has a playful nature and wouldn't mind if the teacher interacted with him in a light-hearted manner.	This understanding of the student's personality helps the teacher tailor his interactions and instructional methods.
13 K: 哦 ((tr. Ah I see)) 14 T: 咁咪同佢玩囉,其實我話唔開名,大家都知道我跟佢,咁大家就好開心繼續聽我講嘢囉係啦 ((tr. Then I decided to play along with him. Even though I won't mention his name, everyone knows that I'm referring to him. This way, everyone can happily continue listening to what I have to say.))		

Table 1: (continued)

Video stimulated recall interview Excerpts	Teacher's perspectives	Analyst's interpretations of the teacher's perspectives
15 K: um hm 咁解釋嘅時候呢,即係你解釋返個variation 呢就,大部份時間都係用英文去解釋,但係去到事後呢,跟住你係再重複多一次,但係用返廣東話去解釋嘅 ((tr. Um hm, when explaining the concept of "variation," most of the time you used English to explain. However, afterwards, you repeated the explanation again, but this time in Cantonese.))		The researcher is interested to understand why would TA switch back to Cantonese in lines 106–111 to explain the content of S15's Instagram post.
16 T: 係啦,然後,總之係囉,有啲同學冇讀physics,咁我都要解一解,佢哋唔係太明呢啲,係啦,又或者同埋可能佢哋唔明我嘅英文 haha 咁所以我可能就要講一次廣東話等佢哋明多啲,係啦 ((tr. Yes, and overall, some students haven't studied physics, so I have to explain it in a way that they can understand. Maybe they are not familiar with these concepts, or perhaps they don't fully understand my English explanations. So, I might have to explain it in Cantonese once to help them grasp it better.))	TA acknowledges that not all students in the class have a background in physics, indicating an awareness of varying levels of prior knowledge among the students.	TA's perspective in this statement reflects a thoughtful and considerate approach to teaching.

TA first explains his rationale for bringing the shared knowledge of a student's Instagram post into the classroom interaction. He claims that he came across an Instagram post by chance and realised that it was related to the mathematical topic that students would be learning in class. He further suggests that connecting the content subject matter to the students' and their classmates' life experiences can enhance engagement and curiosity. *It can be suggested* that TA recognizes the value of creating connections between the subject matter and students' personal experiences. By capitalizing on the familiarity of S15's question, TA establishes a connection between the exclusive shared knowledge, specifically via social media, between

himself and the students. Additionally, TA is aware that S15 has a playful nature and he understands that S15 would not mind if TA interacted with them in a light-hearted manner. This understanding of the student's personality helps the teacher tailor his interactions and instructional methods to better connect with S15 and enhance their learning experience. This pedagogical approach bridges the gap between students' personal experiences showcased on social media and the objectives of the lesson. Not only does it capture the students' interest, but it also highlights the relevance of their everyday lives in relation to the academic content they are studying.

Furthermore, *it can be suggested* that the TA, aware of S15's playful nature, intentionally engages S15 in classroom interactions to help maintain a positive relationship with the student. This approach highlights the importance of relational and rapport-building work that extends beyond the primary pedagogical goal of introducing the topic. Without the TA's facilitation, this translanguaging space could potentially be restricted if the TA chose to exercise strict authority to maintain classroom discipline.

Moreover, TA acknowledges that not all students in the class have a background in physics, indicating an awareness of varying levels of prior knowledge among the students. *It can be argued* that TA's pedagogical belief reflects a thoughtful and considerate approach to teaching. TA recognises that he has the responsibility of ensuring that the content is accessible to all students by explaining it in a way that they can understand. This pedagogical approach reflects an inclusive mindset and a commitment to effective communication and comprehension for all students. Overall, TA's strategic utilization of S15's question that was posted on Instagram and the diverse linguistic and multimodal resources employed in classroom interaction create an inclusive translanguaging space. By tapping into the students' shared knowledge and making connections to the lesson's content, TA fosters student engagement and facilitates students' comprehension of the mathematical concepts in a meaningful way (Tai 2023a).

8.2 Extracts 2a and 2b: incorporating mutually shared knowledge to promote student engagement in the classroom

Extracts 2a and 2b demonstrate how TB and students in the class make use of their mutually shared knowledge of a YouTube video[1] in order to connect with the mathematical knowledge that they learn in class and facilitate playful talk in the classroom. Prior to Extract 2a, T taught students a reason for congruent triangle, SAS (side angle side) and TB gave students some examples for exercise. In this extract, which is at the end of the course, TB provides a brief summary of four reasons for congruent triangle with drawings of different triangles with different conditions. Some students see the summary and get excited about singing a song.

---

1 See the full YouTube video: https://www.youtube.com/watch?v=h4XprRVDm94.

Extract 2a:

```
01 TB: +side angle side
       +TB alternates turning his head to the screen and the students--->
02 (0.1)
03 TB: it is something that we have talked
04 (0.2)
05 TB: today+
          --->+
06 (0.5)
07 TB: +and then +for another one
       +TB stands up and moves toward screen
                 +TB  raises his LH, pointing left index finger to the screen
08 (0.2)
09 TB: +for the second one
       +TB clicks on the pen tool on the screen with pen in LH
10 +(0.3)
    +TB selects the black colour of the pen tool
11 S1: side [side side          ]
12 S2:      [angle [side         ]
13 TB:             +[side side side]=
                    +TB writes down "SSS" to the right of the 2nd row of triangles
                   #14
```
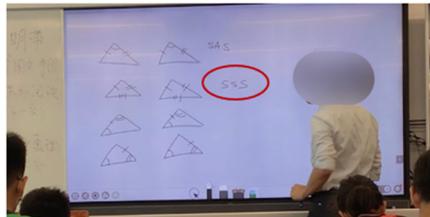

Figure 14

```
14 TB: =[we've talked about that]
15 Ss:  [$side side side$        ]=
       ((students starting to sing the lyrics with rhythm))
16 S5: =+si:de
17 (0.4)
18 Ss:          [si:de]
19 S6: +angle [side ] angle=
       +TB traces over a small dash through one side of the triangle in the 3rd row #15
```
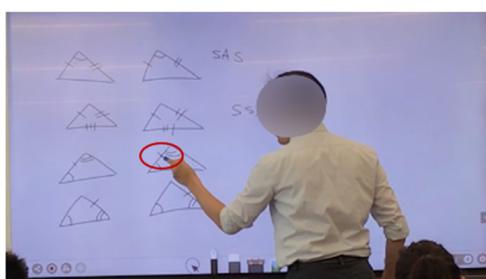

Figure #15

```
20 S7: =+哇我地終於唱得呢首歌喇=
```
((tr. wow we can finally sing this song))
+TB writes "ASA" to the right of that triangle
```
21 S8: =[yea:h]
22 Ss: +[$side angle side$]=
```
((students starting to sing the lyrics with rhythm))
+TB writes down "AAS" below "ASA" #16 --->
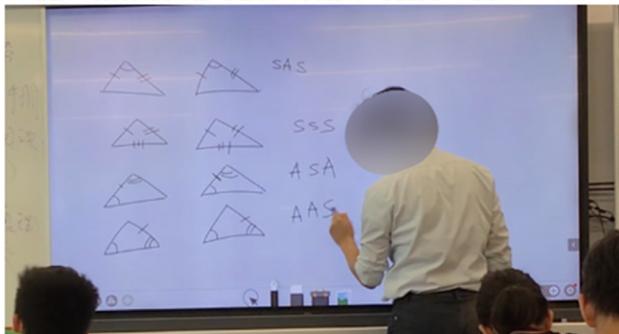
Figure #16

```
23 S8: =[影相 影相 影相+ 影相]
```
((tr. take a photo take a photo take a photo take a photo))
-->+
```
24 Ss: +[$side side side$]
```
((students starting to sing the lyrics with rhythm))
+TB walks towards desk
```
25 Ss: [$side angle side$]=
```
((students starting to sing the lyrics with rhythm))
```
26 Ss: =$side side side$
```
((students starting to sing the lyrics with rhythm))
```
27 (0.4)
28 Ss: +$angle side +angle$
```
((students starting to sing the lyrics with rhythm))
+TB sits on the table
+TB looks at students with smile
```
29 (0.3)
30 Ss: $angle angle ↑side$=
```
((students starting to sing the lyrics with rhythm))
```
31 TB: =(alright so you [know this one) (0.2) XX]
32 S?:                [hhhhhhhhhh           ]
33 (0.4)
34 TB: okay
```

In line 1, TB starts the discussion by mentioning "side angle side" and reminds the students about the teaching point covered earlier in the lesson (lines 2–5). After a brief pause, TB stands up, moves to the screen, and opens the pen tool to prepare for writing (lines 7–9).

After a 0.3-s pause, some students respond with "side side side" (line 11) and "angle side" (line 12). TB agrees with the first answer and writes "SSS" on the screen (line 13, Figure #14). TB continues the conversation by saying that they have talked about "side side side" previously (line 14). While TB explains, some students spontaneously start singing the lyrics with a rhythmic tune, enthusiastically exclaiming "side side side" (line 15). It is unclear how the students learned the song or its purpose. TB does not attend to students' singing and he proceeds to draw a dash on one side of a triangle on the screen (Figure #15) to visually represent the reason behind "angle side angle" when Student 6 mentions it.

In line 20, Student 7 interjects with an uninvited turn and mentions in Cantonese that they can finally sing the song (line 20). Meanwhile, TB writes "ASA" on the screen (line 20). The students in the class continue singing the song together, including "side angle side" (lines 22 and 25), "side side side" (lines 24 and 26), "angle side angle" (line 28), and "angle angle ↑side" (line 30). One student repeatedly says "影相" ("take a photo", line 23), possibly aiming to disrupt the classroom order and encourage students to take photos of the class singing together. The class becomes chaotic with heightened excitement and loud singing. TB does not interrupt the singing but instead smiles and waits for them to finish the entire song (line 28), possibly acknowledging the students' eagerness to complete the song. After the students finish singing, TB acknowledges their singing by saying "alright so you know this one," indicating his understanding of the song that the students have sung.

In Extract 2a, the students actively participate in translanguaging practices by creatively appropriating the song lyrics in a new interactive context. Their enthusiastic use of their vocal abilities to sing the lyrics in rhythm demonstrates their solid grasp of congruent triangles. This extract suggests that there is a mutually shared knowledge among the students and possibly the teacher regarding the song being sung. The students collectively engage in singing the lyrics, indicating a level of familiarity and understanding of the song's content. However, while the students and possibly the teacher share a mutual understanding of the song, the origin and learning process of the song itself remain undisclosed. Extract 2b, occurring three minutes later, illustrates how TB employs a YouTube video to enhance students' comprehension of the distinct characteristics of congruent triangles. Notably, TB utilizes the video that corresponds to the song sung by the students in Extract 2a, indicating a shared understanding and familiarity with the song between TB and the students. This mutual knowledge of the song reinforces the connection and engagement between TB and the students during the lesson.

Extract 2b:

```
121 S3: =+哦 (.) 呢個
           ((tr. ah this one))
         +YouTube loads, and the search results pop up
122 (0.2)
123 Ss: +aaaaaaah +wooo
         +TB clicks on the first video #18
                       +TB clicks on the volume button to mute video & pauses the video
```
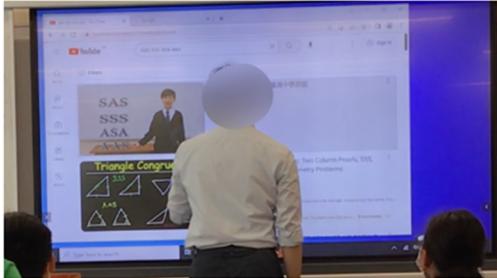

Figure #18

```
124 (1.9)
125 Ss: +$side angle side$
        ((students starting to sing the lyrics with rhythm))

         +TB turns back and looks at students with smile
126 (0.4)
127 Ss: $side side side$
        ((students starting to sing the lyrics with rhythm))
128 (0.3)
129 Ss: +$angle side angle$
        ((students starting to sing the lyrics with rhythm))
         +TB moves to screen and clicks on a button to put the video into full screen
130 (0.3)
131 Ss: +$angle angle +↑side$
        ((students starting to sing the lyrics with rhythm))
        +TB clicks the volume button to cancel the muted setting
                       +TB moves time cursor of the video all the way back to the
                        start on the LHS
132 TB: [okay +so ]
                +TB turns back to face the students
133 Ss: [hhhhh  ]
134 (0.2)
135 TB: +can you can see that (NAME-Researcher) actually know
        +TB walks back towards the desk
136 (.)
137 TB: knows nothing [about the song]
138 Ss:              +[hhhhhhhh      ]
                       +Some students turn back and look at the researcher))
```

```
139 (2.6)
140 Ss: +$side angle side$
        ((students starting to sing the lyrics with rhythm))
         +Some students move their arms to dance to the song--->
         +TB minimizes the Google Chrome window to click on the volume setting of the
           computer
141 (0.3)
142 Ss: $side side side$=
        ((students starting to sing the lyrics with rhythm))
143 Ss: =+$angle side angle$
        ((students starting to sing the lyrics with rhythm))
           +TB clicks on the YouTube video to check its volume setting
144 (0.2)
145 Ss: +$angle angle [↑side$    ]
        ((students starting to sing the lyrics with rhythm))
           +TB clicks on volume setting of the computer again, but still without sound
146 S?:                  [↑aaahaha]
147 (0.3)
148 Ss: $side angle side$
        ((students starting to sing the lyrics with rhythm))
149 (0.2)
150 Ss: $side side side$
        ((students starting to sing the lyrics with rhythm))
151 (0.3)
152 Ss: $angle side angle$
        ((students starting to sing the lyrics with rhythm))
153 +(0.3)
    +TB expands the YouTube video window again
154 Ss: +$angle angle ↑side$+
                        --->+
        ((students starting to sing the lyrics with rhythm))
           +TB walks toward the desk
155(0.2)
156 TB: even you do not have the sound
157 (.)
158 TB: +you (already know) what they are doing
           +TB sits down
```

Prior to Extract 2b, TB introduces the use of YouTube by opening the website, generating excited reactions from the students who eagerly mention the song "櫻花樹下" (under the cherry tree). In this extract, it is evident that student 3 exclaims, "啊! 呢個!" ("Ah! This one!") while TB searches for the video on YouTube. TB clicks on the video and pauses it (Figure #18), causing the students to react with excitement, exclaiming "aaaaaah!" and "wooo" (line 123) in elongated sounds. Subsequently, the

students spontaneously start singing the song together, harmonizing the lyrics "$side angle side$, $side side side$, $angle side angle$, $angle angle↑ side$" (lines 125–131). It is important to note that the video is muted during this time, indicating that the students initiate the singing without any prompting from TB.

After the students finish singing, TB addresses them by stating, "so can you see that ((NAME-Researcher)) actually knows nothing about the song" (lines 135–137), leading to laughter among the students. Some students even turn to look at the researcher, highlighting their perception of the researcher as an outsider in this context (line 138). TB's comment emphasizes the researcher's lack of knowledge about the song, reinforcing the researcher's position as an observer rather than a participant within the classroom community (Wenger 1998). Furthermore, it is remarkable that the students continue to spontaneously sing the lyrics repeatedly (lines 140–154), even without the lyrics being displayed on the screen. During the singing of the song (lines 140–154), some students go beyond vocalizing the lyrics and enthusiastically move their arms in a dancing motion. This physical expression demonstrates their heightened excitement and engagement in performing the song. It suggests that the singing of the lyrics is an integral part of the students' shared repertoire and collective experience within this mathematics class (Wenger 1998). In lines 156–158, TB commends the students' ability to recite the lyrics without relying on the audio from the video.

In this extract, TB initiates a summary of what the students have learned in the lesson. It becomes evident that the students themselves create a translanguaging space by drawing upon their shared knowledge of the song, which pertains to the different reasons for congruent triangles. They utilize their vocal repertoire and employ multimodal features such as loud voices, laughter, and even dance movements. TB facilitates the creation of this translanguaging space by providing the opportunity for students to perform and by displaying the video of the song on the screen, albeit without sound. This allows students to engage in vocalizing the lyrics and reinforces the significance of their act. Moreover, TB's comment regarding the researcher's unfamiliarity with the song highlights the researcher's status as an outsider within the classroom community, establishing a distinct separation between the students' collective knowledge and the researcher's role as an external observer. This moment not only highlights the students' collective identity and cohesion but also reinforces their sense of ownership over the song and their shared experiences related to it. During the video-stimulated-recall-interview, TB comments on the rationales for him to allow students to opportunity to vocalise the lyrics of the song (Table 2).

Table 2: Video-stimulated-recall-interview (Extract 2).

Video Stimulated Recall Interview Excerpts	Teacher's Perspectives	Analyst's Interpretations of the Teacher's Perspectives
01 T: It is noticeable that the students can sing that song without any difficulty. Why? The reason is that these two, these two girls, they learned about this song in drama club. Because they need to … because they need to … they need to … at that time, I know that I, I know that they need to find some video, repetitive on YouTube, repetitive ones to, to explain to the audience that we are having repetitive life and then that girl. 02 R: Repetitive. 03 T: Side angle side. Repetitive. Okay. Hahahaha. 04 R: Hahahahah.	TB knows that some students learn the song through their prior experience in drama club.	
05 T: So that's why they are brainwashed by such a video. So that's why they are the two students that understand first. Right. This is the first thing.	TB acknowledges that music video is brainwashing.	TB is trying to search for a way to engage his students to memorise the reasons for congruent triangle.
06 T: Second thing, I just want to use the video as the summary. Okay, now we have four reasons. And because it is actually the end of the course.	TB makes a plan to play the music video for students as a summary.	TB aims to finish the lesson in plan and satisfy some students' needs.

In the interview, TB expressed his intention to use a music video as a tool to help students recap and summarize what they have learned. The goal is to provide a resource that facilitates students' memorization of the four reasons for congruent triangles. The MCA analysis revealed that some students spontaneously started singing the song. _This can be attributed_ to their prior experience in the drama club, as mentioned by TB. It turns out that several students had already learned this song during their time in the drama club. As a result, they were excited to sing and utilize their knowledge of the song in the mathematics class. This sheds light on how the students learned the song and their motivation for incorporating it into the mathematics classroom. Additionally, several students stood up, danced, and sang along with the

video during its playback (line 140). This dynamic showcases the significance of shared experiences and communal knowledge within the classroom. The students collectively engage in activities that strengthen their sense of belonging and establish a unique community of learners. *It can further be argued* that this process of integrating shared experiences into classroom interactions is facilitated by the students' translanguaging practices. They draw upon their vocal repertoire and multimodal resources, including dance movements, to engage with the content. In other words, the students creatively use translanguaging practices through appropriating the song lyrics in a new interactional context and drawing on their vocal repertoire to sing aloud the lyrics in rhythm. This not only enhances their learning experience but also fosters a sense of inclusivity and active participation among the students.

By creating a translanguaging space that encourages playful talk, TB established a space where students could freely utilize their linguistic and cultural resources to engage with the content. *It can be argued* that such a process requires the teacher to tap into his shared knowledge and experiences as a member of the classroom community. As described in the interview, TB holds the belief that students actively participated in the music video, which served as a mnemonic for the four reasons for congruent triangles. *One could argue* that by engaging in playful talk in the classroom, TB creates an interactive space that encourages students to express their thoughts and participate more actively in classroom interactions (Tai and Li 2021). *We suggest that* this approach necessitates that TB holds a pedagogical belief of not favouring one type of knowledge over another and welcomes students to contribute diverse sources of knowledge to the classroom. This pedagogical strategy, facilitated by TB's understanding of the students' cultural backgrounds and interests, not only allowed the students to mobilize their collective repertoire of singing the song and utilizing the mnemonic, but also captured their attention and potentially deepened their understanding of the topic.

9 Discussion and conclusion

The current study aims to examine how EMI mathematics teachers create a translanguaging space for mobilizing the sociocultural knowledge that is unique to the classroom community for (1) promoting student engagement and (2) facilitating content learning. In Extract 1, Teacher A uses various multilingual and nonverbal cues to enable him to draw upon the shared knowledge of an Instagram post by S15. Such a pedagogical approach introduces the concept of variation through a mathematical equation (Q = V&A). As the lesson progresses, Teacher A strategically uses S15's Instagram question to connect students' prior knowledge with the topic of variations,

engaging them from the start. Teacher A effortlessly switches between languages like English and Cantonese, employing various multimodal resources to make the content easily understandable. Teacher A's intention behind using shared knowledge to introduce the topic is to ensure its relevance and accessibility to all students. In Extract 2, students in Teacher B's class actively engage in translanguaging practices by creatively using song lyrics related to congruent triangles. Their enthusiastic singing demonstrates their understanding of the topic and suggests a shared knowledge of the song among students and possibly the teacher. It is evident that the students create a translanguaging space by drawing upon their vocal repertoire and employing various multimodal features, such as loud voices and dance movements. Teacher B supports this by providing the opportunity for students to perform and display the video on the screen. Teacher B's remark about the researcher's lack of familiarity with the song highlights the collective identity and cohesion among students, as well as their sense of ownership over the shared experiences related to the song.

Prior translanguaging research has demonstrated that EMI teachers can leverage the shared repertoire with their students to cultivate a positive classroom climate and enhance students' motivation in learning content subjects. This includes bringing everyday life experience into the classroom (e.g. Tai and Li 2020) and engaging in cross-curricular connection (e.g. Bozbiyik and Morton 2022; Tai 2023a). In this study, the findings have identified that the EMI mathematics teachers' utilization of sociocultural knowledge exclusive to the teacher-student relationship, facilitated through translanguaging, plays a pivotal role. This paper argues that such a translanguaging space recognizes the invaluable role of sociocultural knowledge in shaping instruction, forging meaningful connections with students, and validating students' lived experiences. This is reflected in the video-stimulated-recall-interviews where Teacher A and Teacher B hold the belief that connecting the students' personal experiences and interests to the lesson's content not only captures their attention but also deepens their understanding of the topic (Tables 1 and 2). This pedagogical strategy, facilitated by the teachers' understanding of the students' cultural backgrounds and interests, bridges the gap between the students' personal experiences and the objectives of the lesson.

Theoretically, the findings substantiate the conceptualization of a classroom translanguaging space as a community of practice for learning (Wenger 1998). In these particular EMI classroom contexts, for both students and teachers to establish legitimate membership and actively engage in the learning processes, the classroom participants need not only to utilize the collective linguistic and multimodal resources but also to tap into the shared sociocultural knowledge specific to this particular classroom community. This pedagogical approach expands the concept of 'linguistic and multimodal repertoires' (Li 2018; Tai 2023a) to include the wealth of

sociocultural knowledge and resources embedded within the classroom community for promoting meaning-making.

Although the study suggests that translanguaging practices drawing on shared insider knowledge can facilitate meaning-making processes and promote student engagement, it is important to recognize that these practices can also create in-groups and potentially exclude outsiders. For example, the use of shared insider knowledge, such as the Instagram post in Extract 1 and the triangle song in Extract 2, can inadvertently marginalize those who are not familiar with it, including researchers. This highlights a limitation of translanguaging, as it is crucial for researchers not to assume that translanguaging inherently empowers individuals, enhances well-being, or transforms unequal communities into fairer ones (Jaspers 2018). The impact of translanguaging practices depends heavily on local circumstances and predominant discourses within specific contexts. Therefore, it is worth investigating how translanguaging may exclude individuals who lack the shared sociocultural knowledge required to participate fully in certain interactions.

Methodologically, the findings underscore the value of integrating multimodal CA with IPA in comprehending the complexities of translanguaging practices during social interactions (Tai 2023b). By triangulating the fine-grained analysis of multimodal CA with the insights gained from IPA analysis, researchers can incorporate additional contextual information that enhances the interpretation of their CA findings. The methodological approach offers insights into the intricate nature of translanguaging practices and the sociocultural factors that impact teachers' use of meaning-making resources which goes beyond the boundaries between different named languages and modes of communication. In the analysis section, it is evident that the triangulation of IPA analysis with MCA analysis enables us to understand how Teacher A came across Student 15's Instagram post and why Teacher A decided to use the Instagram post to introduce the content topic (i.e., variation) (Table 1). Similarly, IPA analysis of Teacher B's interview enables us to understand how students learn the song about congruent triangles and why he creates a space for students to sing aloud the lyrics of the song (Table 2). In both cases, the EMI mathematics teachers tap into their shared knowledge and experiences as members of the classroom community in order to achieve their specific pedagogical goals.

Despite the relatively small scope of the classroom contexts in this study, which includes only two EMI mathematics teachers and two EMI mathematics classrooms, teachers who work with culturally and linguistically diverse classrooms can benefit from this study's findings by understanding the potential of creating a translanguaging space. The findings emphasize the importance of raising EMI teachers' awareness of pedagogical approaches that promote the use of diverse linguistic and multimodal resources for meaning-making and optimize the opportunities for teachers and students to capitalize on mutually shared knowledge during classroom interactions.

Nevertheless, it is crucial for teachers to be mindful of whether the use of mutually shared knowledge might potentially exclude students who are unable to participate in these classroom interactions. This awareness is important to prevent creating a translanguaging space that fosters exclusivity. Furthermore, by incorporating mutually shared knowledge, teachers can tailor their instructional strategies and materials to better align with students' individual needs, preferences, and backgrounds, ultimately creating a more personalized learning experience and promoting students' learning motivation and participation.

Appendix: Multimodal conversation analysis transcription conventions (adapted from Jefferson 2004; Mondada 2018)

Sequential and timing elements of the interaction

[	Beginning point of simultaneous speaking (of two of more people)
]	End point of simultaneous speaking
=	Talk by two speakers which is contiguous
OR	(i.e. not overlapping, but with no hearable pause in between) continuation of the same turn by the same speaker even though the turn is separated in the transcript
(0.2)	The time (in tenths of a second) between utterances
(.)	A micro-pause (one tenth of a second or less)

Paralinguistic elements of interaction

wo:rd	Sound extension of a word (more colons: longer stretches)
word.	Fall in tone (not necessarily the end of a sentence)
word,	Continuing intonation (not necessarily between clauses)
wor-	An abrupt stop in articulation
word?	Rising inflection (not necessarily a question)
wo<u>rd</u>	(underline) Emphasised word, part of word or sound

(continued)

word↑	Rising intonation
word↓	Falling intonation
°word°	Talk that is quieter than surrounding talk
hh	Audible out-breaths
.hh	Audible in-breaths
w(**hh**)ord	Laughter within a word
>word<	Talk that is spoken faster than surrounding talk
<word>	Talk that is spoken slower than surrounding talk
$word**$**	Talk uttered in a 'smile voice'

Other conventions

(word)	Approximations of what is heard
((comment**))**	Analyst's notes
#	Indicating the exact locations of the figures in the transcripts
+	Marks the onset of a non-verbal action (e.g. shift of gaze, pointing)
XX	Inaudible utterances
-->	The action described continues across subsequent lines
—>+	The action described ends

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