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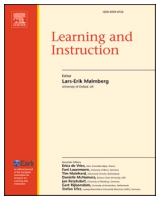

Classroom interactional competence in an English medium instruction mathematics classroom: A creation of a technology-mediated translanguaging space

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ABSTRACT

Content and Language Integrated Learning (CLIL) is an educational approach used in schools and institutions where second language (L2) and content are taught together. CLIL can also be understood as an umbrella term that includes different variants of multilingual programs, which use L2 as the medium of instruction for content subjects. Immersion, Content-Based Instruction, and English-Medium Instruction can be seen as variants of CLIL. The traditional view of languages as separate and bounded entities has been criticized, and the recent conceptualization of 'translanguaging' in the field of Applied Linguistics emphasizes the importance of mobilizing different named languages and multimodal resources in the classroom to make discipline-specific knowledge accessible and cater to the diverse needs of all students (Li, 2018; Tai, 2023). Although there is a growing number of research studies exploring the benefits of multilingualism in multilingual educational contexts, there is still a lack of research investigating the role of multilingualism in CLIL classrooms. This special issue aims to study how teachers and students utilize their diverse multilingual and multimodal resources to facilitate the teaching and learning of content and linguistic knowledge in CLIL classrooms. It seeks empirical papers that conceptualize multilingualism as the norm in CLIL classrooms and investigate pedagogical practices that develop students' content knowledge and thinking skills. Topics of interest include the effective use of multilingual practices or translanguaging in CLIL classrooms, designing multilingual CLIL assessments, and CLIL teacher professional development in multilingualism.

1. Introduction

English-Medium-Instruction (EMI) is an educational approach where teachers deliver their content lessons in the English language. This policy and practice are primarily implemented in countries and regions where English is not commonly spoken by the majority of the population (Macaro, 2018). English-Medium-Instruction places emphasis on content learning, considering L2 acquisition as a secondary outcome. In other words, the main priority of EMI education is to facilitate students' acquisition of subject-specific knowledge, while English language learning often occurs as a secondary and implicit process. EMI continues to be prevalent in post-colonial areas, like Hong Kong, which is the focus of the current study. It is also gaining popularity in developing economies where acquiring English skills is considered a crucial aspect of global integration and internationalization (Sah and Li, 2020).

To date, there remains limited research exploring the process of mobilizing diverse linguistic and multimodal resources in EMI environments, which restricts the ability of EMI educators to utilize various language resources for teaching or classroom management purposes (Ho, 2022). Classroom Interactional Competence (CIC) in second language (L2) classrooms refers to "teachers' and learners' ability to use interaction as a tool for mediating and assisting learning" (Walsh, 2011, p. 132). The ability to use appropriate language to promote learning opportunities is essential to CIC. Despite the increasing theoretical explication and specification of CIC as a construct, there is a lack of acknowledgement of the fluidity of interaction in CIC research (Tai & Dai, 2023). Studies on CIC have not explored the dynamic movement that transcends the boundaries between named languages (e.g. English and Cantonese) and other semiotic systems (e.g. gestures, signs and visual images).

In the current post-COVID-19 pandemic era, L2 teaching and learning is increasingly multilingual, multimodal and digital (Chen, 2022; Jeon et al., 2022). Research in the field of Computer Assisted Language Learning has demonstrated how the use of technology devices

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allows L2 teachers to customise classroom materials and their teaching plans according to students' needs (e.g. Engin & Donanci, 2015; Liu & Chao, 2017; Mathieu, 2021). Nevertheless, there remains a lack of research that explores how EMI teachers can employ such technological devices for learning in content subject classrooms that adopt L2 as the medium-of-instruction (Liu & Chao, 2017; Matsumoto, 2021). Therefore, understanding how technological devices can be employed by EMI teachers appropriately and strategically can enable researchers and teacher educators to assess the effectiveness of employing such technology for content and language learning.

Based on a larger linguistic ethnographic project in a Hong Kong EMI secondary mathematics classroom, this study utilizes a case study methodology and employs translanguaging as an analytical framework to investigate the teacher's CIC. In the context of this study, not all students do not share a common first language with their EMI teacher. Therefore, the school implements a single-language EMI approach, utilizing English in EMI classes to promote both content and language learning. Specifically, this study will focus on how an ethnic minority EMI mathematics teacher's application of the iPad broadens his selection of various multimodal repertoires to facilitate and support ethnic minority students' learning of mathematical knowledge and academic language. The study will address the following research question.

1) How does the EMI mathematics teacher employ different multimodal resources to create a space for translanguaging in the classroom?

2. EMI in Hong Kong

Choosing the language of instruction has been a controversial issue in Hong Kong's education system, where Cantonese is the primary language for most people, and English is the L2. HK's secondary schools have gone through three stages of medium-of-instruction policies, including a laissez-faire approach before 1994, compulsory Chinese-Medium-Instruction (CMI) policy from 1998 to 2010, and a more flexible policy since 2010. Under the current policy, secondary schools can offer EMI, partial-EMI, and/or CMI classes. CMI schools can choose their language of instruction for content subjects if they meet certain criteria (Education Bureau, 2009). As a result, a significant number of secondary schools are using EMI for at least one academic subject, with roughly 30% of schools implementing EMI across all grades and 40% using it for at least one subject according to the Secondary School Profile in 2019–2020.

Due to a growing number of South Asian students in Hong Kong, many secondary schools are now admitting students from diverse linguistic and cultural backgrounds. In response, some schools with a significant number of non-Chinese speaking students may offer EMI classes to meet their needs. According to the Legislative Council, there has been a 155% increase in the number of ethnic minority students in HK schools, rising from 7136 in 2005/06 to 18,200 in 2016/17. This has led to more schools needing to cater to the needs of non-Chinese speaking students. Research studies have demonstrated that many ethnic minority students have grown up in HK or migrated to HK as a child and they are able to speak fluent Cantonese. Nevertheless, they continue to confront issues including education, future employment, adaptation to a homogeneous Chinese society and racial discrimination, as reported by the press, statutory bodies, academic research studies, and non-governmental organisations (e.g. Tsung et al., 2012). Therefore, the monolingual EMI policy is incompatible with the multilingual environment that ethnic minority students have experienced during their childhood. This can potentially hinder them from learning the content knowledge and participating in the EMI classroom interactions.

3. Classroom interactional competence

CIC refers to teachers' and learners' ability to use interaction as a tool for mediating and assisting learning, with the goal of enhancing opportunities for learning. The development of CIC is grounded in the concept of interactional competence (IC), as proposed by Young (2003) and Hall and Pekarek Doehler (2011). IC refers to the capacity to effectively coordinate actions in a mutual manner. This involves the interplay between participants' utilization of linguistic and interactional resources within specific contexts (Hall & Pekarek Doehler, 2011; Young, 2003). On the other hand, the notion of 'communicative competence' that was coined by Hymes (1972) has furthered our understanding of language teaching methodologies and it focuses on the ways in which speakers employ linguistic, semantic, and discourse resources to create meaning. It is important to note that although the notion of communicative competence differs from the constructs of IC and CIC, the notion of communicative competence focuses on the individual ability to produce correct utterances instead of focusing on speakers' joint competence (Tai & Dai, 2023; Walsh, 2013). Essentially, communication is a joint enterprise which entails collective competence by all parties as speakers and listeners have a responsibility in negotiating or clarifying meanings or ideas during a conversation. Moreover, while IC focuses on the relationship between interactional and linguistic resources, CIC is more concerned with the relationship between interaction and language learning. Specifically, CIC emphasizes the importance of capturing teachers' and students' actions in classroom interactions for promoting learning opportunities (Walsh, 2011). It suggests that interaction is at the centre of teaching and learning, and teachers can construct learning opportunities by developing their CIC and making appropriate interactional decisions.

Walsh's initial concept of CIC encompasses a set of broader pedagogical skills that are common to all classroom contexts (Walsh, 2011, p. 52). This includes.

1) using language which aligns with the pedagogical goal of the moment and which is appropriate to the students;
2) maximising interactional space in the classroom through allowing increased wait time and planning time and encouraging extended student turns;
3) shaping students' contributions by taking a student's response and doing something with it instead of merely accepting it. This can be achieved through initiating clarifications, scaffolding, modelling, paraphrasing, reiterating, repairing students' input, and summarising;
4) making use of effective eliciting strategies by asking questions and encouraging students to initiate questions.

In addition to these interactional features, a growing body of research has revealed additional interactional features that can form part of teachers' CIC. These features include the use of multimodal and semiotic resources like gestures and objects (e.g. Sert, 2015; Can Daskın, 2015) to shape students' contributions, managing student uninvited initiatives (Waring, 2011), use of students' L1 to maximise learning opportunities (Can Daskın, 2015; Sert, 2015; Zuo & Walsh, 2021) and use of minimal response tokens (e.g. 'Mm hm') to confirm listenership and encourage student participation (e.g. Girgin & Brandt, 2020).

As previously mentioned, Walsh's conceptualisation of CIC pays particular attention to teachers' appropriate use of verbal language to shape students' contributions. For example, assisting a student to extend and elaborate on their responses instead of merely accepting them as a type of scaffolding (Walsh, 2011). The teacher's use of multimodal resources in shaping a student's response is not well-acknowledged in

Walsh's conceptualisation of CIC (e.g. Sert, 2015). More importantly, the concept of CIC has not yet recognized the fluid nature of language use for achieving successful classroom interaction. This involves switching between registers, styles, languages, as well as across communicative modalities in order to mediate meaning-making processes (Li, 2018).

4. Technology integration in L2 classroom

Since this paper aims to look at the EMI teacher's use of iPad in expanding his choice of using different multimodal repertoire to mediate and assist students' learning of content knowledge and academic language, it is vital to review studies that explore technological integration in L2 classrooms. In the field of Computer Assisted Language Learning (CALL), research studies have shown that technological devices can promote students' L2 reading and listening skills, increase students' motivation in learning an L2 (Oberg & Daniels, 2013) and enhance their L2 oral proficiency (Lys, 2013). Studies investigating the role of technological devices in social interactions have examined how smartphones shape the dynamics of social interactions in classroom settings (e.g. Eilola & Lilja, 2021; Mathieu, 2021; Matsumoto, 2021). Mobile devices, such as iPads, can be moved and are easy to carry. The touchscreen function provides affordance for various modes of communication, such as tapping, sliding, touching, and dragging as the teachers or students employ their fingers to manipulate the material content on the screen. The integration of iPads into lessons enables their easy utilization for group discussions and whole-class teaching (e.g., Mathieu, 2021). In a recent study conducted by Mathieu (2021), the use of iPads by secondary school students was explored in terms of identifying and recognizing information, as well as creating private and public workspaces during collaborative tasks. The analysis demonstrated that the affordances of iPads played a crucial role in facilitating students' collaborative interactions. This was attributed to the ability of students to engage in multimodal forms of interaction, such as touch-based communicative modes (e.g., touching and keyboarding), which contributed to higher-level actions like knowledge construction and information retrieval. Similarly, Eilola and Lilja (2021) investigated the role of smartphones as cognitive artifacts in supporting the participation of L2 students in an adult L2 Finnish classroom. The authors argued that the affordances of smartphones were beneficial for students' use of and learning in the L2, as smartphone usage encouraged their active engagement in classroom interactions. The analysis demonstrated how the student's use of a phone could serve as a personal cognitive artifact, which is a man-made device for supporting students' cognitive abilities and their use of L2 for participating in the interaction competently. In other words, the smartphones offered support to L2 students such as allowing them to check meaning with the Google voice recognition application in order to re-formulate their questions or utterances. In a study conducted by Matsumoto (2021), the focus was on examining how adult English-*as*-a-second-language learners utilized smartphones as a valuable tool for L2 learning. Matsumoto contended that the self-initiated use of smartphones by students showcased their active engagement in the learning process and their adeptness in employing a variety of semiotic resources strategically to participate effectively in classroom interactions.

Although there are a considerable number of studies looking at the use of mobile devices in supporting teachers' L2 teaching in language classrooms, there are limited studies exploring how EMI teachers can employ mobile technological devices, such as iPads and smartphones, for facilitating the process of teaching abstract content knowledge and academic language in content subject classrooms. Tai and Li (2021) conducted a recent investigation that revealed how an EMI mathematics teacher enhanced his ability to create a technology-mediated learning environment in the mathematics classroom for multilingual minority ethnic students through the utilization of an iPad. This allowed the teacher to expand his range of semiotic and spatial resources for instruction. Nevertheless, the study only revealed the use of translanguaging in scaffolding students' content learning and it provided no qualitative evidence of how the creation of a technology-mediated translanguaging space can support students' learning of both content knowledge and academic language. In order to fill in the identified research gaps, this study unpacks how the EMI teacher, despite being situated in a linguistically restricted space that is heavily influenced by a monolingual mindset, breaks the artificial boundaries of multimodal resources to support students' content and language learning. The next section will briefly introduce the context of EMI in Hong Kong context.

5. Translanguaging in multilingual classrooms

The notion of translanguaging has gained attention in recent scholarly educational discussions, with the argument that named languages, including Chinese and English are socio-political constructs and they do not reflect psychological realities (Li, 2018). Translanguaging highlights the capacity of a speaker to utilize their full linguistic and semiotic repertoires to create meaning. As a pedagogy, translanguaging is not only a practice that involves using full multilingual and multimodal resources. It can provide pedagogical and interpersonal functions in the classroom, including enhancing students' understanding of the curriculum, promoting inclusion and participation, preventing communication breakdown, and maintaining fluent and meaningful interactions (Creese & Blackledge, 2010; Lewis et al., 2012). Translanguaging also allows for creativity and critical thinking by utilizing the diverse communicative resources of multilingual individuals (Li, 2011). Examples of using translanguaging practices in a multilingual classroom can include using labels or signs or posters in various named languages, inviting students to translate new English vocabulary in their first languages (L1s) or identify cognates in their L1s, and asking students to discuss a topic in small groups using any language they prefer, but they must share their discussion in English with the whole class. As a theory of language, translanguaging recognises that "human communication entails the coordination and interpretation of a vast array of semiotic resources that are entangled with language in fluid and unpredictable ways" (Hawkins, 2018, pp. 55–56). Translanguaging has a social justice orientation, in which Otheguy et al. (2015) define translanguaging as "the deployment of a speaker's full linguistic repertoire without regard for watchful adherence to the socially and politically defined boundaries of named (and usually national and state) languages" (p. 283). As an analytical perspective, translanguaging challenges the perspective that there are boundaries between different named languages, linguistic varieties and other communicative means. In other words, an important objective of adopting translanguaging as an analytical perspective is to shift our analytical attention away from a language as abstract codes to a focus on attending to a wider range of multilingual and multi-semiotic resources for achieving meaning-making. Such a perspective refuses to privilege specific communicative modes or methods of meaning-making over others (Li, 2018). Particularly, the transcending of modalities is an important part of translanguaging which distinguishes it from the concept of code-switching, which attends to the functional aspects of the linguistic mode without considering the multimodal aspects of meaning-making practices.

While it is widely accepted that translanguaging involves more than just language switching and includes the integration of various semiotic and modal resources to construct meaning (Li, 2018; Ho 2022), the exploration of its multimodal aspect has been limited. Specifically, there

is a lack of research examining how translanguaging occurs in English Medium Instruction (EMI) settings, which restricts EMI teachers' ability to effectively utilize different linguistic resources for pedagogical purposes and classroom management. Existing translanguaging studies have primarily focused on the multilingual aspects of utilizing the complete language repertoire of students in EMI classrooms (e.g. Jakonen et al., 2018; Sah & Li, 2020; Phyak et al., 2022). Consequently, this study aims to investigate how a translanguaging space is established within the constraints of the EMI classroom context, with a particular focus on the utilization of multimodal resources. The study seeks to uncover how EMI teachers, despite operating within a linguistically confined environment influenced by a monolingual mindset, overcome artificial boundaries to leverage multimodal and technological resources to enhance students' learning of content subjects.

Additionally, Li (2022; 2018) conceptualises the notion of 'translanguaging space' which is an interactional space for speakers to mobilise multiple multilingual, multimodal, and multi-sensory repertoires to create new meanings. Li (2011) further argues that a translanguaging space enables speakers to bring their funds of knowledge to the forefront (Moll et al., 1992). The funds of knowledge can include different dimensions of their prior life experience, attitudes, linguistic and cultural knowledge, social identities, beliefs, and their knowledge of the wider institutional environment. Teachers can use these funds of knowledge as resources in the process of constructing ideas and facilitating students' learning.

Recent research in applied linguistics has emphasized the importance of translanguaging as an inclusive and transformative pedagogical resource in multilingual classroom contexts (Tai & Li, 2020; 2021; Phyak et al., 2022; Sah and Li, 2020). A recent ethnographic study by Phyak et al. (2022) illustrated how EMI teachers used translanguaging to resist monolingual EMI policies and acknowledge students' home languages as resources for effective pedagogy. Tai and Wong (2022) focused on how a native English-speaking teacher constructed a translanguaging space to develop native English-speaking students' English learning. The authors demonstrated how the English teacher's construction of a translanguaging space had a transformative effect on students' content and language learning. These studies have demonstrated the teacher's ability to create a translanguaging space to achieve specific pedagogical goals, such as managing student misbehaviours (Tai, 2023b), expanding students' linguistic repertoire (Tai & Wong, 2022), and breaking linguistic barriers to support learning (Phyak et al., 2022; Tai, 2022). However, existing research tends to focus on the multilingual aspects of mobilizing full linguistic repertoires (e.g. Tai & Li, 2020). This case study aims to illuminate how an EMI teacher, situated in a linguistically-restricted space dominated by a monolingual English-only policy, uses the iPad and other semiotic resources to break artificial boundaries of modal resources and facilitate students' content and language learning.

Furthermore, while CIC has been theorized as a collaborative creation of classroom interaction, research on CIC has not fully recognized the changing nature of communication modes, frames, footing, and the use of multilingual and multimodal resources (see section 3 for more information). The primary analytical focus of analysing a teacher's CIC is on identifying the sequential pattern of talk, including turn-taking, response tokens and adjacency pairs (Walsh, 2006). Translanguaging, on the other hand, highlights the fluid nature of language use in the classroom, where participants draw on available linguistic and semiotic resources from different languages and modalities to create meaning and knowledge. It is vital to note that the notion of translanguaging has not been acknowledged as an element of CIC. In this paper, I build on the notion of translanguaging and argue that teachers' capacity to use diverse multilingual and multimodal resources afforded by technological tools to achieve different pedagogical goals in specific moments of the multilingual classroom interaction is a reflection of their CIC. From a translanguaging perspective, competent language users need to make appropriate assessments of what, how, and why specific resources should be employed in specific moments of interaction. Such a capacity to coordinate different resources reinforces the concept of a 'translanguaging instinct' (Li, 2016) which highlights a speaker's innate capacity to exploit different multisensory and multimodal resources to interpret the meaning intentions in social interactions. Recent conversation analytic researchers argue that the teacher's ability to manage language alternation (Zuo & Walsh, 2021) and use multimodal resources to scaffold learning (Sert, 2015) are features of CIC, making translanguaging a feature of CIC. A recent study by Zuo and Walsh (2021) explored how teachers' use of translation between L1 and L2 is being achieved in English-*as*-a-foreign-language classrooms in Chinese universities. The authors argued that translation is a fluid translanguaging practice which contributes to the creation of a space for learning, and thus is a feature of CIC. Hence, this paper aims to substantiate the argument that conceptualizing teachers' translanguaging practices as part of their CIC can identify the mobility, fluidity, and locality of multilingual and multimodal resources that contribute to student engagement and facilitate content and language learning.

6. Methodology

This study employs a case study design (Yin, 2009) to examine the EMI mathematics teacher's practices over a specific period. Case study is a qualitative research approach, often considered as a form of ethnographic study design (Creswell, 2012). It involves exploring a bounded system or multiple systems (cases) in real-life settings collecting detailed and in-depth data from multiple sources (Creswell, 2013, p. 97). The adoption of a case study approach allows for thorough and nuanced interpretations of the EMI teacher's translanguaging practices, utilizing methods such as MCA analysis and video-stimulated-recall-interviews with member checks. It should be noted that this study is based on a 4-month linguistic ethnographic investigation conducted in Hong Kong EMI secondary mathematics classrooms (Tai, 2020). The primary aim is to investigate how translanguaging incorporates specific interactional features to achieve pedagogical objectives at specific moments during lessons, as well as how the teacher's understanding of his translanguaging practices is expressed through interviews.

6.1. *Participating school*

The secondary school is a typical school that offers education to a high concentration of South Asian (SA) students. Approximately 80% of the student population is classified as South Asian students. The choice of this school as the site of this research is because the school has a strong reputation in adopting EMI for offering education to SA students for an extensive period of time. This context is distinct from other EMI classrooms in Hong Kong, where the teacher and students usually share the same first language (L1), which is Cantonese (e.g. Poon, 2010; Tai & Li, 2020). The head of the school strongly supported the implementation of iPads as a tool to enhance high-quality education and learning experiences. The school implemented an iPad policy, drawing upon the principal's own teaching experience and his perception that iPads possess the potential to enhance student engagement and improve the quality of teacher instruction during classroom interactions (e.g. Liu & Chao, 2017; Tai & Li, 2021). The first author has received approval by the school principal to carry out ethnographic data collection at the school which can potentially offer new perspectives to research on EMI classroom interactions. The school has also recruited a small group of local Hong Kong and mainland Chinese students. The first author conducted observations of a year 10 EMI mathematics class for a period of over a month. The class was composed of 38 students from diverse national backgrounds, including 14 Pakistanis, 11 Nepalese, 8 Indians, 3 Filipinos, 1 Yemeni, and 1 Russian. All students were 16 years old and had received at least 6 years of primary education in which English was the medium-of-instruction. The EMI teacher considered the SA students' English proficiency to be satisfactory. Many of the SA students in the

class had either grown up in Hong Kong or migrated to the city at a young age, and they were able to speak or understand Cantonese. Since not all SA students share a common first language with the teacher, the school adopts a monolingual EMI policy where English is used during EMI lessons to facilitate content and language learning.

6.2. Participating teacher

The EMI mathematics teacher is Heads of Mathematics and Science departments at the participating school. He belonged to a small group of teachers at the school who identified as an ethnic minority. The researcher invited him to be a participating teacher in this study and he was willing to participate in this study as he was interested in learning more about implementing translanguaging in multilingual classroom settings. It is noteworthy that the teacher involved in the study frequently used an iPad for teaching (according to my field notes) which motivates me to explore the teacher's pedagogical approach in drawing the technological affordances in scaffolding students' learning of mathematical knowledge and academic language. He is an L1 speaker of Urdu and Punjabi. Arabic, English, Cantonese and Mandarin are his additional languages. He attended EMI schools for his early childhood, primary, secondary and university education.

This study is grounded in the framework of translanguaging, and it is essential to clarify certain key aspects. The research takes place in a Hong Kong EMI classroom, involving teachers and students from diverse linguistic and ethnic backgrounds. The teacher considers the students to have satisfactory English proficiency levels, and it is important to note that they do not share a common first language (L1) with the teacher or their classmates. More details on this can be found in section 6.1. Additionally, the EMI teacher lacks linguistic competence to utilize the students' respective L1s for translating subject-specific vocabulary into English or providing examples from their everyday lives to explain abstract concepts. It can be argued that some South Asian students in the class who speak Urdu and Punjabi share the same L1 with the teacher, potentially allowing the teacher to use their linguistic resources to support mathematical learning. However, in this particular classroom, there are students who also speak other L1s, including Russian and Filipino. Therefore, it is important for the teacher to mobilise the resources that are familiar to all students in order to make the discipline-specific knowledge accessible to all students and promote social inclusion in the EMI classroom (Tai, 2022).

6.3. Data collection

A semi-structured interview was conducted with the participating teacher two weeks before the classroom observation, which aimed to gain a deeper understanding of their views on multilingualism in EMI classrooms (Hammersley & Atkinson, 2007). This interview lasted for an hour. Following this, eleven 40-min EMI mathematics lessons taught by the participating teacher were video-recorded over a two-month period, during which the first author attended all the lessons.

Two months after the observation, a post-video-stimulated-recall-interview was carried out, allowing the researcher and the teacher to discuss interpretations of the teacher's pedagogical practices (Speer, 2005). Before conducting this interview, the researcher selected eight short video clips that highlighted the teacher's translanguaging practices. The teacher then watched these clips and explained their reasoning for using translanguaging in those specific moments. This approach aimed to encourage the teacher's reflection on their pedagogical practices while also enabling the researcher to clarify aspects not evident through observation alone. The video-stimulated-recall-interview lasted for 1.5 h. In the subsequent analysis, data from the video-stimulated-recall-interview will be discussed after examining each classroom interactional extract.

For presenting the classroom analysis, I have chosen representative excerpts rather than presenting every transcribed interaction in this study. However, this could create concerns about whether the analysed extracts are truly representative. To address this issue, the following factors were taken into account.

1. The presented extracts should be comparable to other extracts, either directly or indirectly, as suggested by Ten Have (1990).
2. Deviant cases should also be considered, following Ford (2012).

Hence, the analysed extracts should be interrelated to demonstrate how interactional features recur in similar instances or are used in different ways in deviant instances (Ten Have, 1990). The chosen extracts in this paper are typical examples of translanguaging practices in this particular EMI mathematics classroom, and no atypical sequences were found. It is important to note that the goal of MCA analysis is to identify the "devices" or "the technology of conversation" in situated interactions, rather than to justify the best possible representative extracts (see section 6.4). Thus, as long as the selected extracts can address the research question and reveal the relevant "orderliness" with their representative nature, the representativeness is considered sufficient, and the research findings are deemed reliable to a large extent.

6.4. Combining Multimodal Conversation Analysis with Interpretative Phenomenological Analysis

In this study, the primary analytical framework employed is Multimodal Conversation Analysis (MCA), which is used to address the research question. MCA is centered around examining how social order is collaboratively constructed by members within a social group (Brouwer & Wagner, 2004, p. 30), through detailed analysis of social interactions. MCA takes an emic/participant-focused approach, and it discourages researchers from pre-theorizing the significance and relevance of language use, including various semiotic resources such as gestures and images. In other words, 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 data. MCA extends Conversation Analysis by including the analysis of the role of multimodal actions in social interactions, such as body movements and manipulations of objects. Such an analytical perspective aligns with the translanguaging perspective since the notion of translanguaging posits that multimodal actions are as integral to social interaction as linguistic utterances (Tai, 2023a,b,c). With its micro-analytic lens, MCA allows researchers to uncover how the processes of teaching and learning emerge and are jointly constructed in talk-in-interaction (Hellermann & Lee, 2014). The data were transcribed using Jefferson's (2004) and Mondada's (2018) transcription conventions (see Appendix). Screenshots from the video-recording were also included in the transcripts in order to present multimodal interactions in the EMI mathematics classroom.

The issues of reliability and validity in qualitative research are frequently discussed, with scholars like Bryman (2001) addressing these concerns. Seedhouse (2004) argued that MCA has its own procedures to ensure validity and reliability when analyzing naturally occurring interactions from an emic perspective. These procedures differ from mainstream research methods operating under an etic paradigm, which often involve inter/intra-reliability ratings to assess data analysis reliability. Consequently, many of the threats to reliability and validity that apply to other research methods do not necessarily apply to MCA research (Seedhouse, 2004; Sert, 2017). Firstly, the reliability of MCA findings is linked to the detailed and accessible nature of the transcripts used. MCA analyses are presented alongside the data transcripts,

allowing readers to examine the analysis process and evaluate the validity of the analyst's conclusions. This transparency permits readers to scrutinize the analyses repeatedly. Secondly, to ensure validity, analysts must base their observations on the observable orientations and understandings of the participants themselves. In other words, the analysis is grounded in how participants respond to each other's speech, rather than relying solely on the analyst's interpretations. This approach necessitates a close examination of interactional details to maintain the emic perspective and uphold the validity of the analysis (Seedhouse, 2004). Consequently, analysts cannot make claims beyond what is explicitly illustrated by the interactional details.

The MCA findings were triangulated with the video-stimulated-recall-interview data which was analysed using IPA. The IPA analysis of the interview data will offer additional insights into the classroom analysis. 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). By doing so, it allows researchers to take an emic approach (i.e. participant-relevant approach) (Conrad, 1987; Smith et al., 2013) in order to understand how the teacher makes sense of his translanguaging practices at specific moments in the classroom interactions. The second hermeneutic, which involves researchers interpreting participants' interpretations of their experiences, encourages the integration of theoretical concepts from external sources to explain psychological phenomena. This approach, adopting an etic perspective, enhances the emic analysis of participants' lived experiences. To incorporate a critical analysis of classroom discourse, I initially conducted a microanalysis of the classroom talk. This is then complemented by triangulating it with an IPA (Interpretative Phenomenological Analysis) of data from video-stimulated-recall interviews. It is important to note that this process maintains the analytical rigour of MCA without compromising its integrity.

In order to present the IPA analysis in a way that can help readers to navigate how the researcher makes sense of the teacher's trying to make sense of his teaching, a table with four columns was designed and presented in the Analysis section (see section 7). From left to right, the first column revealed the classroom interaction transcripts. The second column presented the video-stimulated-recall interview transcripts. The third column demonstrated the teacher's perspectives on his translanguaging practices. The final column entailed the researcher's interpretations of the teachers' perspectives, which aligns with IPA's two-stage interpretation process (i.e. double hermeneutic).

7. Analysis

In this section, I will present three extracts which are taken from the EMI mathematics classroom. These representative extracts are interrelated in order to demonstrate the typical instances of translanguaging practices in the EMI classroom which demonstrates how the EMI teacher's use of the iPad extends his multimodal repertoire for facilitating students' learning of 1) academic language (i.e., Extract 1) and 2) mathematical knowledge (i.e., Extracts 2 and 3).

7.1. Employment of iPad for promoting learning of academic language

In this sub-section, one representative extract will be presented to showcase how the teacher uses iPad for facilitating students' learning of academic language.

7.1.1. Extract 1

Prior to the extract, the teacher (T) asked students to complete question 5 individually. The question first provides a context: "the number of marbles owned by Danny is 4 times that owned by Cecily. If Danny gives 27 of his own marbles to Cecily, they will have the same number of marbles". Students are required to "find the total number of marbles owned by Danny and Cecily". In order to find the total number of marbles, students will need to draw on the knowledge related to factorisation in order to solve the question. While students are completing the question, T draws a male and a female via his iPad in order to represent 'Danny' and 'Cecily'. After 5 min, T draws students' attention as he is going to provide feedback on this particular question.

In this extract, it is evident that T uses an iPad to enhance student understanding of mathematical concepts and academic language. By writing a mathematical statement on the iPad (line 3) and zooming in for clarity (line 7), the teacher emphasizes the importance of the subject-specific term "respectively" to students. Additionally, T uses iPad features, such as highlighting and gestures, to link mathematical symbols and their corresponding constructs "Danny", "Cecily", "x" and "y" (lines 25–35). T's recap of the term "respectively" (lines 40–42) further solidifies the concept by demonstrating how to match subjects in the same order. Overall, the use of the iPad allows the teacher to employ various visual and interactive techniques to facilitate students' learning of subject-specific vocabulary and mathematical content knowledge. This extract demonstrates how T employs various iPad functionalities, such as zooming in and out, to clarify the term 'respectively', as well as using text highlighting in different colours. Alongside verbal expressions and gestures, T elicits student responses and focuses their attention on the subject matter. These translanguaging practices showcase T's CIC, as he effectively utilizes different multimodal resources appropriately to facilitate students' learning of subject-specific vocabulary.

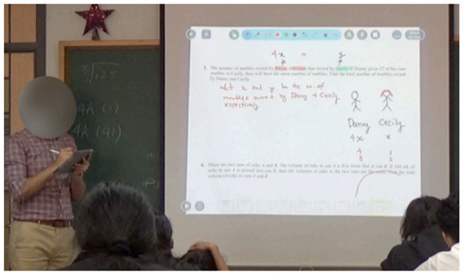
01 T: alright so +we have our first statement

+T zooms out to show the full math question

02 (0.7)

03 T: +so fir- uh please write this down let x

+T writes "Let x and y be the no. of marbles owned by Danny + Cecily respectively." in red pen via iPad under the question #1 -->



#Figure 1

04 (1.6)

05 T: and y:

06 (18.5)+

--->+

07 T: +okay (0.2) uh (.) excuse my ugly handwriting

+T looks at the screen, uses iPad to zoom in to the words he has just written

08 (0.5)

09 S?: no problemo=

10 T: =now (1.1) +instead of writing +into two steps- eh

+T raises his LH to the written words on the screen, all fingers extended

+T clenches his LH into a fist

11 T: =different statements Δyou can ye- uh write it in oneΔ

ΔT shakes his LH fist forward and backward-->Δ

12 (0.7)

13 T: +make sure to add the word respectively=

+T extends his LH thumb and index finger, pointing at the word "respectively" --> #2

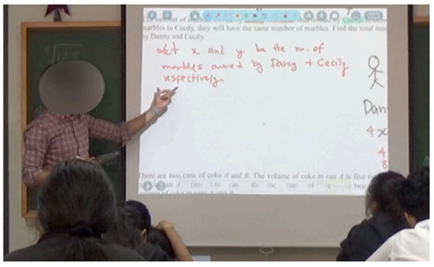


Figure #2

14 T: =what does respectively+ means? +what are you indicating?=

-->+

+T rotates his LH, keeping thumb and index finger extended, palm facing himself

15 SS: =you respect

16 (0.3)

17 SS: hahaha[hah]

18 S4: [you] need to respect

19 (0.3)

20 T: thank you (1.0) +for this information

+T switches from the pen to the highlight function on iPad, picks yellow highlighter color

21 (0.6)

22 S?: heh=

23 S2: =+yes sir no problemo

+T highlights the letter "x" in yellow via iPad #3

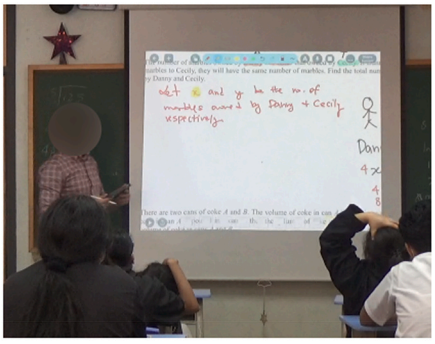


Figure #3

24 (0.4)

25 T: +so that means (.) x

+T raises his LH, fingers extended toward letter "x", palm facing the screen

26 (0.3)

27 T: +is the number of oh- marbles owned +by:

+T lowers his LH slightly to point towards second line "marbles owned by Danny + Cecily"

+T moves his LH forward to point at the word "by"---> #4

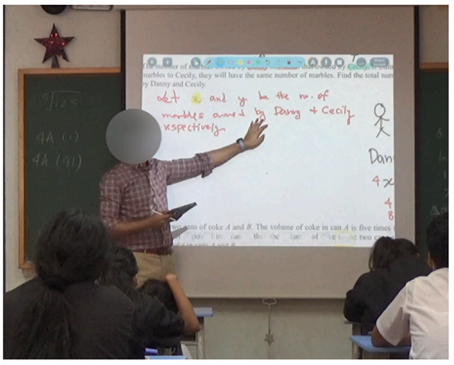


Figure #4

28 (1.1)+

--->+

29 S3: da[nny]

30 T: [danny]

31 +(1.8)

+T highlights "Danny" in yellow #5

32 T: +and then (.) +y is the number of marbles owned by:

+T switches highlighter color from yellow to green

+T highlights "y" in green #5

33 (0.2)

34 S3: +cecily=

+T highlights "Cecily" in green #5

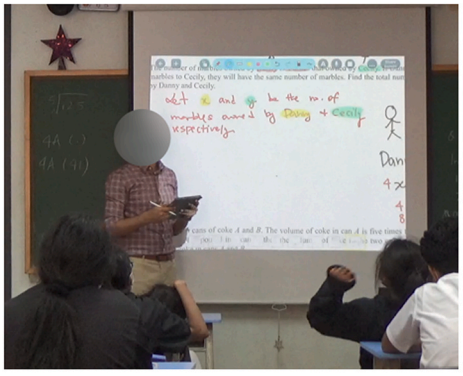


Figure #5

35 T: =cecily=

36 S4: =cecily

37 (0.2)

38 T: +alright (.) so

+T turns to face the screen, raising his LH to point at "respectively", fingers extended, palm facing the screen

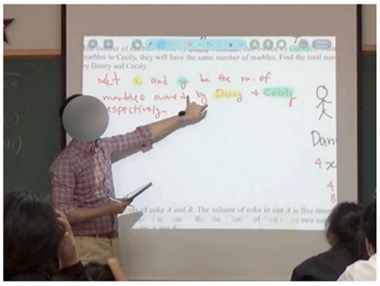
39 (0.7)

40 T: +when we write respectively +we just +match it

+T taps LH fingers repeatedly on the screen under "respectively"

+T clenches their LH, only extending pinky, index finger and thumb

+T moves his LH back and forth between "x and y" and "Danny + Cecily" --> #6 #7



#Figure 6

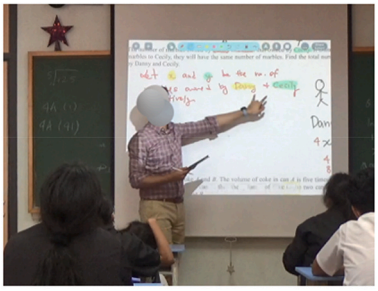


Figure #7

41 (0.3)

42 T: alright the first and the latter one+

-->+

T first poses a question for answer checking by writing a mathematical statement and asks the students to write down "let x and y be the number of marbles owned by Danny and Cecily respectively" (lines 1–3). T then uses a red pen to write the statement on his iPad (line 3) and zooms in to the words he wrote (line 7) to ensure all students can see it (Figure #1). T then explains the importance of the adverb 'respectively' by pointing at it (Figure #2) and emphasizing its significance: "make sure to add the word respectively" (line 13). T asks the students to interpret the meaning of 'respectively' (line 14).

It is noticeable that some students interpret the word 'respectively' as having its typical English meaning of 'respect' (i.e. admiration shown to someone important) and respond with "you respect" (line 15). This interpretation differs from the mathematical meaning of 'respectively' which refers to the same order as the mathematical items mentioned (i.e. 'x' and 'y'). Other students laugh in response to these answers (line 17), which may indicate that they find the interpretation inappropriate. Although one student (S4) repeats the inaccurate response (line 18), T responds sarcastically by thanking S4 for their contribution even though it does not add much to the discussion (line 20).

In the following part of the interaction, T uses various features of the iPad to explain vocabulary. T starts by highlighting the letter 'x' in yellow on the iPad (line 23, Figure #3) and refers to it verbally while pointing at it (line 25). T then asks a designedly-incomplete question in line 27 and simultaneously moves his left hand towards the second line ('marbles owned by Danny + Cecily') and points at the preposition 'by' (Figure #4) to prompt the students to identify the person represented by 'x'. A student utters 'Danny' (line 29) which T accepts in line 30, indicating his/her understanding of the mathematical question. T highlights 'Danny' in yellow (Figure #5), which helps the students group 'Danny' and 'x' together. T switches highlighter colour to green, highlights 'y' (Figure #5), and asks another designedly-incomplete question in line 32 to prompt the students to identify the representation of 'y'. After that, a student correctly says 'Cecily' (line 34) which T acknowledges by highlighting 'Cecily' in green (Figure #5) in order to group 'Cecily' and 'y' together (line 35). From lines 25–35, it is clear that T uses different colours to group the mathematical items with their corresponding English names: 'Danny' with 'x' and 'Cecily' with 'y.'

T recaps the step-by-step instruction to the previous introduction of the term 'respectively' (line 13) by demonstrating how students can match the subjects in the same order, 'the first and the latter' (lines 40–42). This is supported by T's gesture of moving back and forth between 'x' and 'y' and 'Danny' and 'Cecily' (figures #6 and #7) in order to indicate their connections.

This extract has revealed how T uses various iPad features to explain 'respectively,' including zooming in and out to display the mathematical statement and highlighting texts in different colours while using verbal utterances and different gestures to elicit student responses and draw attention to the topic. These translanguaging practices demonstrate T's CIC due to his appropriate use of resources to support student learning of subject-specific vocabulary. Students in the class show an understanding of 'respectively' in academic writing, as evidenced by their ability to respond to T's guided questions (lines 29, 34, and 36) that require them to connect the mathematical values 'x' and 'y' with the names 'Danny' and 'Cecily.'

7.2. Employment of iPad for facilitating students' learning of mathematical knowledge

In this sub-section, two representative extracts (Extracts 2 and 3) will be presented to showcase how the teacher uses the iPad for facilitating students' learning of mathematical language.

7.2.1. Extract 2

Prior to the extract, T was demonstrating the mathematical procedures for solving an exponential function. Using an iPad, T visually presented the steps to the students. Following the presentation, T encouraged the students to carefully examine the provided solution and inquire about any aspects they found confusing or did not comprehend (line 2).

In this extract, T is trying to use the iPad as a resource for facilitating the process of connecting students' everyday life experience and mathematical knowledge. The MCA analysis shows a classroom interaction where a student, S4, expresses uncertainty about a mathematical solution (lines 4–9). This uncertainty leads to surprise and laughter from other students and T (lines 11–22). T uses an iPad to visually explain the concept through drawings of cakes and pieces, prompting students to participate in answering questions (lines 25–38). S4 eventually realizes the correct answer, resulting in more laughter and teasing from the class (lines 39–43). Overall, T's use of the iPad aids in visually simplifying the concept, encouraging student engagement and understanding.

S4 utters a hesitation marker 'huh?' in high intonation which denotes his uncertainty about the mathematical solution (line 4). He then goes on and explains his doubt: 'how one plus one over three equals to four' (line 6). This immediately leads to responses from students in the class, as shown in line 7 when student 5 (S5) utters an exclamation 'oh my god' to reveal his surprise and student's laughter in line 10. As S5 continues to criticize S4's inability to grasp the answer (line 11), T frowns, closes his eyes and holds his head in his right-hand (figure #9), which potentially indicates his disbelief and astonishment at S4's inability to understand the simple mathematical steps.

A student then repeats the phrase "use calculator" to emphasize how using a calculator can help S4 solve his math problem (line 13). T acknowledges the student's contribution and identifies the issue S4 is struggling with. He then attempts to transition to a new sequence of the lesson (as suggested by his use of 'okay?', line 18) (see Looney et al.,

2017) and says "no problem back to primary (0.4) four" (line 18) in an ironic tone that suggests the question is at a primary four level. S1 adds to T's response by saying "four and five" (line 20), and T responds by stating that the question is at a primary three level (line 22), highlighting its simplicity. S4 responds by saying "I got it (.) yes sir please I got it" (line 23) repeatedly, possibly to avoid being embarrassed by T doing a mathematical explanation in front of the class. Meanwhile, T moves to a blank page on his iPad and starts writing.

T begins a new sequence by using the word "now" and speaking in everyday language rather than mathematical language, as seen in his use of a conditional clause starting with "if I have one piece of cake" (line 25). While speaking, T draws a circle on his iPad to represent the cake (figure #10). This action prompts laughter from the students, which is taken playfully by the class. T then continues constructing the if-clause by drawing a plus sign and a triangle (figure #11) to represent one-third of a cake. He then asks the students how many cakes he has (line 29), but no one responds, and some students laugh, indicating the simplicity of the question. During a 10-s pause, T changes his iPad pen colour from red to blue and divides the circle into small triangles (figure #12) to draw attention to the cake being divided into pieces.

T provides scaffolding to the students through drawings and then poses a designedly-incomplete utterance, "but this cake has been split into?" (line 32), inviting the students to complete it. Several students respond with "three" (line 34), which T acknowledges in line 36. T asks another question, "so in total how many pieces do I have?" (line 36), and the students can look at the drawings on the screen to answer. They respond with "three," which T confirms (line 36). T then asks a final follow-up question and provides a hint by pointing at the screen, and S5 loudly answers "FOUR PIECES" (line 39) which prompts S4 to utter a change-of-state-token 'oh' (Heritage, 1984) and several acknowledgement tokens 'yeah yeah' (Jefferson, 2002) which indicate his awareness of the correct answer. Simultaneously, T writes down 4/3 on his iPad in blue colour to make sure all students can notice the correct answer on the screen. Several students are clapping (line 42) and laughing (line 43) which possibly treats S4's realization of the accurate answer as laughable. In lines 48 and 52–53, T teases S4 with ironic comments about finally understanding the simple solution, leading to more laughter (line 55). S4's realization of the correct answer is possibly seen as humorous by the class.

In this extract, it is evident that T utilizes the iPad to address the inquiries made by S4. T employs the iPad for multiple purposes: 1) creating visual representations, such as drawings of a circle and triangle to depict specific mathematical values, 2) using his finger to point at the drawings on the screen, providing hints and guidance to the students, and 3) utilizing different colours of pens to differentiate his drawings. Additionally, T employs an everyday life example of a cake, demonstrating how he leverages the iPad to connect this relatable knowledge to the mathematical explanation. This approach aims to capture students' attention and scaffold S4's comprehension of simple fractions. During the video-stimulated-recall-interview, T is invited to reflect on his pedagogical strategies in addressing S4's question and employing drawings to facilitate learning (Table 1).

The researcher aims to understand T's willingness to address a simple question raised by S4. T explains that it is crucial to address students' questions in order to establish a safe learning environment. T expresses this belief by stating, "I don't really care what type of questions it is because I've created an environment where they're okay with asking any questions, so I have to make sure I live up with it." This pedagogical belief contributes to fostering a safe space for mathematics learning in the classroom. T also mentions incorporating humour when addressing simple questions, which helps build a positive rapport with the students. This is evident in the MCA analysis, which reveals T's use of facial expressions and gestures (line 11) as well as various drawings on the iPad (lines 25, 27, and 31) to simplify the mathematical question, resulting in laughter among the students.

It is notable that T utilizes the iPad's capability to use different colours to draw a circle and a triangle, representing various sizes of cakes that metaphorically represent numerical values. This approach aids S4 in understanding how to solve simple fractions. T believes that relating everyday objects to numerical values helps students grasp the question more effectively. This pedagogical belief aligns with the concept of integrating out-of-school knowledge into the classroom, bridging the gap between everyday life knowledge and academic knowledge (Tai & Li, 2020). T further explains that connecting everyday life knowledge to mathematical explanations helps students recognize that mathematics is present in our daily lives, stating, "So again, reminding them the roots of math is actually, it's all everywhere around us." Therefore, T's educational belief regarding mathematics teaching and learning provides students with an opportunity to establish connections between mathematics and everyday life situations. This contributes to the creation of a technology-mediated translanguaging space for students, enabling them to recognize the various semiotic resources, academic and everyday language used by T to promote content learning.

7.2.2. Extract 3

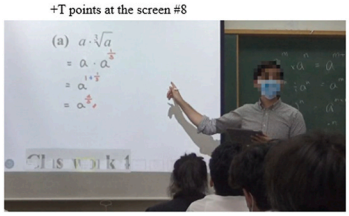
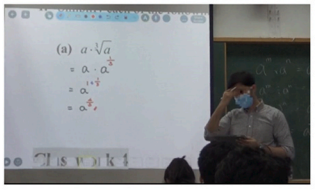
Prior to the extract, T assigned two mathematical questions for students to solve. The first part of the question requires students to use factorisation to solve the equation, $9a^2$-27a+14. Students then need to use the result of the first part of the question to factorise the subsequent equation, 9 $(b+1)^2$-27 (b+1)+14. In other words, students need to substitute the value of 'a' into 'b+1' in order to look for the answer. T walked around the classroom and supervised students' work-in-progress and he realised that all students failed to factorise the second part of the equation accurately. In line 13, T walked to S10's seat and took a photo of his work in order to publicly display S10's work on the screen (Figure #17). By doing so, T decided to use S10's work as an example to explain the errors that students in the class have made in solving the equation.

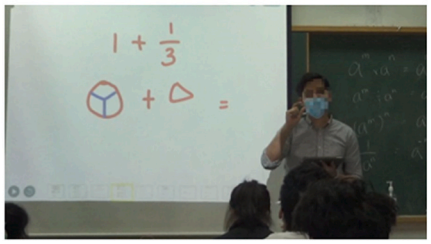
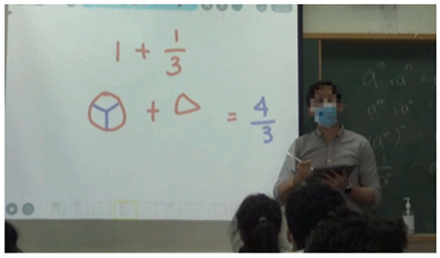
In this extract, T provides feedback on S10's work and identifies any errors made by S10. In particular, T uses an iPad to help students understand the process of substituting values and solving a mathematical equation. By zooming in on a student's work (lines 23, 64, 81–85), highlighting specific values (e.g. lines 55–59, 78, 106), and providing step-by-step examples (e.g. lines 39–45 and 47–49), T guides the students through the process. He employs designedly-incomplete utterances (e.g. lines 41, 64, 78) to engage the students in identifying connections between values and applying mathematical rules. T's use of the iPad enables him to visually emphasize and teach important mathematical concepts, leading to improved student understanding of applying the methods of multiplication and explanation of brackets for solving algebraic formulas.

In lines 23–26, T uses his iPad to zoom in on the question so that other students in the class can see S10's work. Specifically, T highlights the values 'b+1′ in yellow so that the markers can see which values need to be replaced (lines 25–26) (Figure #18). Before evaluating S10's answer, T reminds the students by pointing to the answer to the first part of the question (lines 30–32). T points to (3a-7) on the screen (Figure #18) and asks the students to identify the connection between the values '3′ and 'a' (line 32). T points to '3′ and 'a' separately and then moves his finger back and forth between them to encourage the students to identify the connection between the two values. This action results in the students understanding that the connection between the values of '3′ and 'a' involves multiplication, as evidenced by their response of 'times' in lines 34–35.

After acknowledging the students' responses (line 37), T introduces a side-sequence (Jefferson, 2002) and focuses the students' attention on an example he will use in upcoming turns (line 39). T uses his iPad to move to a blank page and writes down '3a′ in red pen (Figure #19). He then writes 'a = ' in the top right corner and asks the students to identify the value for replacing 'a' by uttering a designedly-incomplete phrase, 'now replace a with' (line 41). The students immediately respond by saying 'b' in unison (line 42), and T writes down 'b' on his iPad (Figure #20). He then asks another designedly-incomplete utterance, 'this will

Table 1
Video-stimulated-recall-interview (Extract 2).

Classroom Interaction Transcript	Video Stimulated Recall Interview Excerpts	Teacher's Perspectives	Analyst's Interpretations of the Teacher's Perspectives
01 +(3.0) +T zooms in and displays the question via his iPad 02 T: +anyone does not get this part +T points at the screen #8  Figure #8 03 (1.1) 04 S4: huh? 05 (1.2) 06 S4: l don't get how [one plus one over three] equals to four 07 S5: [oh my god (NAME S4) doesn't get it] 08 (0.4) 09 S?: use calculator= 10 SS: haha= 11 S5: =+sir (NAME S1) doesn't get it haha +T frowns, closes his eyes and holds his head in his RH #9  Figure #9	01 K: So, during this moment you are trying to address a student's question. And then it's dealing with basic primary level mathematics. What do you feel at that moment, because that student was asking a kind of like a low-level question? How were you feeling at that moment? 02 T: I think um at the beginning of the year of my teaching, I would get frustrated but then you know what I've learned throughout these years is if a student is even asking the simplest of all even		The researcher is interested to understand why T bothers to address the student's primary level question.
12 (1.4) 13 S?: use calculator 14 (0.4) 15 T: okay calculator +yes= +T points at S? 16 T: =but he wants to +understand the logic behind it +T moves his RH in circular motion 17 (1.6) 18 T: okay no problem back to primary (0.4) four 19 (0.3) 20 S1: four or five 21 (0.4) 22 T: primary three= 23 S4: sir: l got it (.) yes sir +please (2.0) +l got it like +T moves to a blank page +T starts writing via iPad (1+1/3) 24 (0.6) 25 T: now (0.5) if l have +one piece of cake= +T draws a circle on his iPad#10  Figure #10 26 SS: =hahaha=	primary level question and I dismissed it in front of the whole class. It's not going to be a good impression on the student because the student has confidence to even ask such a question. That means you're she's feeling safe and, you know, I don't really care what type of question is because I've created an environment where they're okay with asking any questions so I have to make sure I live up with it. And even if it's a simple question, I will explain it, even if it will take some time. You know, I usually add humour in it to you know make it less boring so um yeah i feel i think that's just my way of keeping a	T believes that it is important to address students' questions in order to create a safe space of learning for the students. T admits that he will add humour when addressing students' simple questions.	It is noticeable that T's pedagogical belief (aiming to create a space in the classroom) motivates him to respond to S4's simple mathematics questions. This is reflected in the MCA analysis as T enacts gestural actions and makes ironic comments to tease S4's inability

27 T: =+plus (0.5) +one third of the cake +T draws a plus on his iPad +T draws a triangle on his iPad #11  Figure #11 28 (0.8) 29 T: how many +cakes do I have= +T draws a '=' sign on his iPad 30 SS: =hahaha 31 +(10.0) +T uses a blue colour pen to draw the pieces of cake via iPad #5 32 T: +but this cake has been split into? +T points at the pieces of cake #12  Figure #12 33 (0.2) 34 SS: three 35 (.) 36 T: three (0.5) +so in total how many pieces do I have +T points at the triangle	classroom principle and my principal way of doing it. Yeah, I think, because I hate dismissing students. That it might be really, really simple. And I think it's always a good way to, you know, recap on things on the simplest fractions. So, you know, maybe if they have learned, they will again have a vivid, you know, impression on this. So yeah, I mean, whenever there's an opportunity. I just take it and yeah. 03 K: Um hm. And then I also noticed that you are doing lots of drawings on the screen to explain the you know the fractions. What pedagogical effects	T emphasises that it is good for students to recap the knowledge that students have acquired before.	to solve simple fractions. Through recapping, T aims to assist students in memorising simple mathematical knowledge.
37 (.) 38 T: +small ones= +T curls his thumb and index finger to form a c-shaped gesture #13  Figure #13 39 S5: =FOUR PIECES= 40 S4: =+oh: yeah yeah yeah +T writes down 4/3 on his iPad #14  Figure #14 41 (0.5) 42 SS: (clapping)= 43 SS: =+hahaha +T tilts his head towards the answer on the screen #15	are you trying to create there? 04 T: I think um I'm just trying to connect fractions are essentially what we deal with everyday and using an object that they see every day like cakes. And converting them into numerical values or fractions is actually interchangeable. It's just they often do not make this connection. So again, reminding them the roots of math is actually, it's all everywhere around us. So, you know, using pictures to translate into numerical values or operations is actually not difficult. It's always there. So, yeah.	T believes that using everyday life objects and converting them into numerical values can help students to better understand the question. T also wishes students to recognise that mathematics is part of our daily life.	T is attempting to bridge the gap between everyday life knowledge and academic knowledge. T is trying to connect mathematics to everyday life situations.

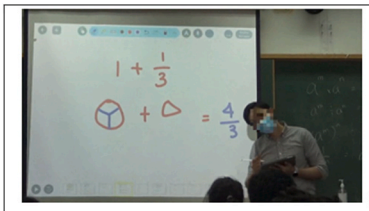


Figure #15

44 (0.2)
45 T: +okay=
+T erases the writings on the iPad
46 SS: =+hahaha
+T switches back to the page with the mathematical question #16


Figure #16

47 (0.4)
48 T: it's it's it's nice to see
49 (1.8)
50 SS: sh:
51 (0.5)
52 T: it's nice to see nearly um five years or six years=
53 T: =after your primary you finally +understood this
+T points at the screen
54 (0.5)
55 SS: hahahaha

become what' (line 43), which leads to students' response of 'three b' (line 45). T acknowledges students' response by writing down '3 b′ on his iPad (Figure #21) and erases it to indicate that he will move on to another example.

T provides another example of the value of 'a' being equal to 'a+1' (lines 47–49) and asks the students to consider whether the value '3a′ will be equal to '3a+1′ after the substitution (line 49). T writes down the possible answer '3a+1′ on his iPad (line 49), but the students reject it by saying 'no' (line 51) and explain the need for adding brackets to indicate the multiplication of '3′ and 'a+1' (line 55). T adds the brackets in blue pen (Figure #22, line 55) and writes down '3a + b' in blue to acknowledge the students' response and visually indicate the final answer.

T summarises the issue that the students failed to notice and underlines 'a+1′ in blue (Figure #24) as he explains the process of multiplying two mathematical terms (lines 59–62). He zooms in on the photo and uses another designedly-incomplete utterance, 'we have to add a?' (line 64, Figure #25), to encourage the students to pay attention to the blue brackets, which signify multiplication. The students repeatedly say 'bracket' to indicate their understanding of adding brackets when multiplying two or more mathematical terms.

In line 73, T ends the side-sequence and returns the students' attention to the main mathematical question they were struggling with by switching back to S10's work on the iPad (Figure #26). T asks the students to identify the mistake S10 made (line 74), which prompts S1 to say 'bracket' (line 76). Although T begins a designedly-incomplete utterance, 'where (0.2) between,' to encourage the students to specify the exact locations for the brackets, his use of a red pen to mark the brackets around 'b+1′ has interactionally completed the utterance (line 78, Figure #27). In lines 82–88, T uses the zoom function and writes a short sentence on his iPad ('add brackets when multiplying two or more terms') to highlight the mathematical rule on the screen for all students to see (Figures #28, #29, and #30).

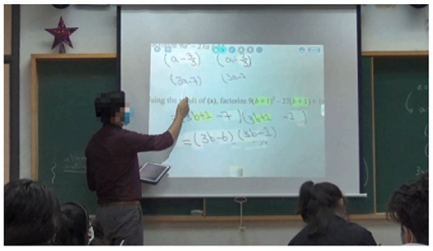
After giving mathematical advice to the students, T zooms out of the photo and returns to S10's work (line 92) to have the students evaluate it. In lines 94–106, T directs students' attention to the equation '3 (b+1)-7′ and asks several questions while pointing at the mathematical values to prompt the students to solve the equation by expanding the bracket (lines 94, 98). The students respond accurately (i.e. 3 b + 3) (lines 95, 100), demonstrating their ability to apply T's previous teaching of multiplication. T acknowledges their answers by writing the correct mathematical values in red pen (lines 97, 101).

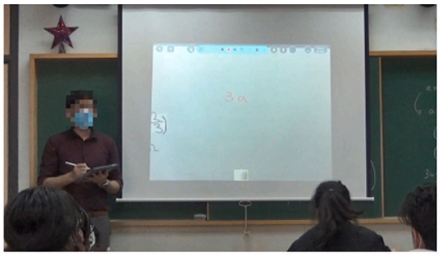
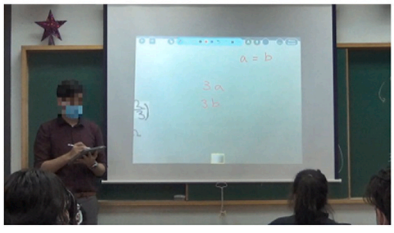
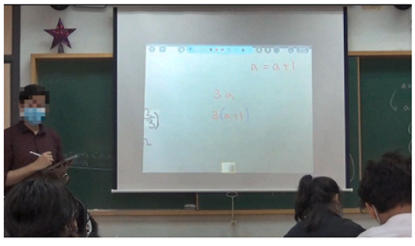
After constructing a new solution (i.e. '3 b + 3′), T asks another designedly-incomplete utterance, 'then minus?' (line 102), and points at '-7′ to prompt the students to include the original value in the new solution. T acknowledges a student's response (line 104), says 'seven,' switches to a black pen on his iPad, and writes '-7′ with brackets around the solution (line 106, Figure #32).

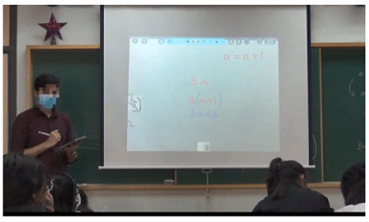
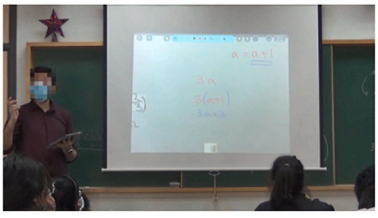
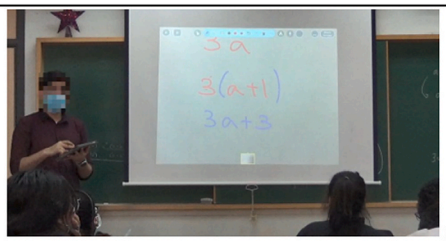
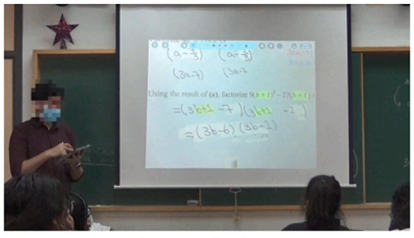
T uses a red pen to write down '3 b + 3′ when solving the next part of the equation (i.e. '3 (b+1)-2′), and later switches back to a black pen to write down the value that S10 correctly included in their response (i.e. '-2′) (line 110, Figure #35). Finally, T crosses out S10's final answer with a black pen and displays the correct answer (' (3 b+3–7) (3 b+3–2)') to all students (line 110, Figures #35 and #36).

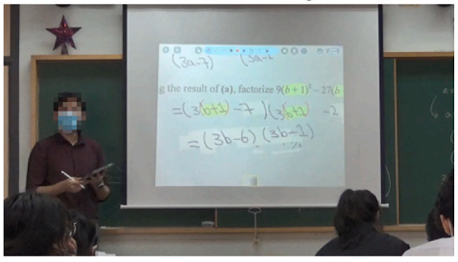
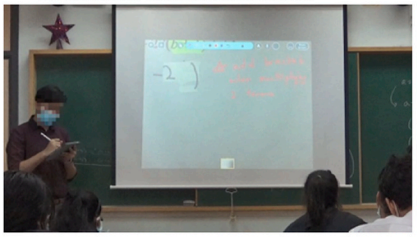
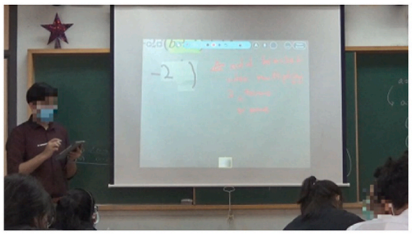
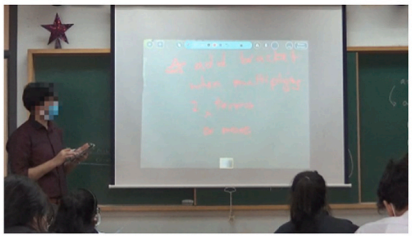
Extract 3 reflects T's competence in mobilizing different technological and multimodal resources to shape his verbal English explanations in order to make such mathematical explanations understandable to students. Throughout the teaching process, T makes use of the functions afforded by the iPad in order to scaffold the teaching of abstract mathematical questions. This includes features, such as zoom in/out function, switching between pages, writing mathematical values with different colours and taking a picture of the student's work and projecting the photo on the screen in order to enable T to achieve his pedagogical goal, which is to explain how students can apply the methods of multiplication and explanation of brackets in order to solve the algebraic formula. During the video-stimulated-recall-interview, T reflects on his

Table 2
Video-stimulated-recall-interview (Extract 3).

Classroom Interaction Transcript	Video Stimulated Recall Interview Excerpts	Teacher's Perspectives	Analyst's Interpretations of the Teacher's Perspectives
13 T: can I use one example (0.4) +okay you would like that +T walks to S10's seat 14 +(2.1) +T takes a photo of S10's work 15 S7: three b minus six equals to what 16 (0.3) 17 S1: what is this? 18 (0.3) 19 S10: shut up (NAME S1) 20 (0.5) 21 T: +okay (1.8) alright the sooner we finish this +T walks back to the screen #17  Figure #17 22 (0.3) 23 T: the sooner you can leave +(4.6) okay (0.4) now +T zooms into the question via iPad 24 (2.7) 25 T: I appreciate those students who highlight it at least= 26 T: =you can visibly see what we are replacing 27 (0.4) 28 T: with the +a 29 +(1.6) +S10 waving her RH repeatedly 30 T: now (2.0) +now +T points at (3a-7) on the screen #18	01 K: Can you briefly tell me what was going on in the classroom? 02 T: mmm so I think we were doing a factorization question so the question um. It's a very typical DSE question and often they have misconception on this part. So before letting them know (what) we're going to be doing. I just let them do the question first, because I guaranteed my, most likely 99% of the students will actually make the mistake. And	T acknowledges that students would make mistakes when doing a factorisation question.	
 Figure #18 31 (0.3) 32 T: +three and +a what's the +sign between them +T points at '3', which is part of the equation (3a-7) +T points at 'a', which is part of the equation (3a-7) +T moves his index finger between '3' and 'a' to and fro 33 (0.3) 34 S1: times= 35 SS: =times 36 (0.5) 37 T: +times (2.2) now okay shh guys have a look 38 (1.0) 39 T: +completely not related but somehow related +T waves his RH from LHS to RHS, palm facing students 40 (0.2) 41 T: +have a look here +(4.2) now replace a with= +T adjusts the page and moves to a blank space via iPad +T writes down '3a' on his iPad #19 +T writes down 'a=' via his iPad	sometimes you know the best way to learn from something is from making mistakes. So for this question and let them work on it and see how they can work based on the previous question. And um I walk around for I think for around 5 to10 minutes and then realize that majority of students were wrong. So, and then I just took a picture of one of the students and then brought back the idea of substitution. When you're substituting more than one terms it is slightly different, because the value is also changed for the constant term. So yeah,	T makes use of the photo taking function afforded by iPad in order to provide corrective feedback to all students.	T utilizes an iPad as a projector to first take a photo of S10's work and display it on a large screen for the class to see. This allows the students to observe how S10 approaches solving a mathematical equation. Additionally, T can use gestures to direct the students' attention to specific mathematical

 Figure #19 42 SS: =b= 43 T: =+b (0.8) this will become what +T writes down 'b' vis his iPad #20  Figure #20 44 (0.9) 45 SS: three b 46 (0.3) 47 T: +three b (1.0) right? +(0.9) now I replace it +with: +T writes down '3b' on his iPad #21 +T erases '3b' on his iPad +T tilts his head towards his right	so I through the student's work and I asked them to correct. So basically, I asked the student herself to see where will she make her correction. And she did. And then I also forced them to add a remark with the star. So, this way, you know, not only to force them to develop their note. But also, in a way, it's a good reminder for this question in the future. So yeah, that's pretty much. 03 K: um. So, yes. So, I think, you know, similar to one of the previous videos that we		values during the process. In the MCA analysis, T makes use of the zoom in and out functions and red colour pen to provide mathematical advice to all students. It can be inferred that by using the camera feature, T can display a student's work on the screen, which motivates other students to identify any mathematical mistakes made by the student. This creates a learning
 Figure #21 48 +(1.2) +T writes down 'a+1' 49 T: a plus one (1.3) would it become +three a plus one +T writes down '3a+1' 50 (0.5) 51 SS: no no 52 (0.5) 53 T: +what is missing +T spreads out his RH and points towards the students, palm facing upward 54 (0.2) 55 SS: bracket +bracket +T adds the brackets using blue colour pen #22  Figure #22 56 (0.9)	have just seen like it's similar to how you provide feedback for students, you know, you know you you take pictures of the student's work, you, you know, upload it on the screen. And then you evaluate it. But what I find interesting is that, you know, when you're marking the student's work and providing the answers, you are using black color to illustrate the steps that student has successfully achieved, but using red color to represent the part that are additional to that student's original answer. Have you noticed that kind of		atmosphere where students can engage with authentic materials. It can be contended that using an iPad allows T to use various coloured pens to highlight important mathematical values for the students to concentrate on. This can be advantageous for students who learn best through visual aids.

57 T: so it should be +(0.3) three a plus (1.2) +three +T writes down "3a+" in blue colour +T writes down '3' next to '3a+' in blue colour #23  Figure #23 58 (0.8) 59 T: so if you remember +if we are placing (0.3) the a +T underlines "a+1" in blue colour #24  Figure #24 60 (1.3) 61 T: or= 62 T: =if you are multiplying with more than two terms 63 (0.4) 64 T: we have to add +a? +T zooms in and displays the equation to students #25	systematic markings that you have done in the video? 04 T: I know what you are talking about. It's just I am not aware of this. I think, yeah, I think, again, it's it's it's unconsciously I will do it. And I know it's useful to them again to let them see again, which is the part that is, you know, calculated from that particular part so they can see the difference between the two terms on the bracket. 05 K: yeah. So yeah, at the very beginning is actually quite systematic but towards	T emphasises that he wishes to highlight the mathematical terms that are derived from the brackets and the terms that come from S10's original steps.	The researcher believes that T's use of colour pens is systematic and helpful for students to differentiate the two different mathematical terms. Using two different colours to differentiate the different parts of the mathematical solution.
 Figure #25 65 (0.3) 66 S1: bracket 67 (0.2) 68 SS: bracket 69 (0.3) 70 T: bracket 71 (1.2) 72 SS: oh: 73 +(0.4) +T switches back the page back to S10's work #26  Figure #26 74 T: so what is S10 missing here 75 (0.3) 76 S1: bracket 77 (0.5)	the end when you are presenting the final answer. You're using the you know black color. So that's why I was wondering how come you're not using the red color to represent the final answer, because that's something because that's not what the student has eventually achieve. 06 T: oh okay. I mean not bracket part I wanted to ***highlight*** those two terms are derived from the bracket. Okay, if you look at the video, you will see the 3b plus three is actually the bracket. The minus	T aims to visually differentiate the terms that come from the expansion of the bracket.	

78 T: where (0.2) +between +T uses a red colour pen to mark the brackets via iPad #27  Figure #27 79 (5.5) 80 T: okay everyone else also please have a look 81 +(0.4) +T zooms out the page via iPad 82 T: and then put a star +here +T draws a star next to the equation 83 +(15.2) +T zooms in and writes a short sentence #28  Figure #28 84 T: alright add bracket when multiplying two terms 85 +(2.0) +T zooms out the page via iPad	seven is just from the original step. 07 K: yes yes 08 T: So that's why I just wanted to highlight. So, the bottom one didn't really matter because it's just the answer. So, I could have used any color, but the emphasis was I wanted them to see the red one was coming from the expansion of the bracket. 09 K: Ohhhh okay I get it. I see.		
86 T: alright? or two or one 係啦 two or one more accurate *((tr. that's right))* 87 +(3.5) +T adds '^or more' to the short sentence via his iPad #29  Figure #29 88 T: alright? two or more terms 89 (0.6) 90 T: +um l zoom in it's hard to see +T zooms in the page via iPad, showing the sentence #30  Figure #30 91 (0.7) 92 T: alright so (0.7) +very crucial (1.2) so we will have what +T moves the page back to S10's work 93 (0.8)			

94 T: +three times +b become what
+T points at '3', which is part of the equation of 3(b+1)
+T points at 'b', which is part of the equation of 3(b+1)
95 (0.3)
96 SS: three b
97 +(1.0)
+T writes down '3b' in red colour via his iPad #31

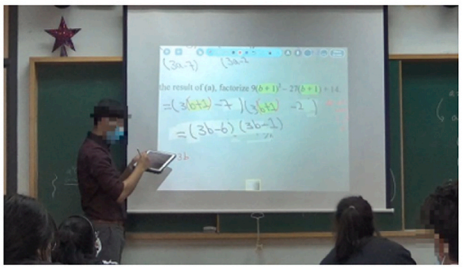


Figure #31

98 T: +three times +one
+T points at '3', which is part of the equation of 3(b+1)
+T points at '1', which is part of the equation of 3(b+1)
99 (0.5)
100 SS: three
101 +(0.3)
+T writes down '3' in red colour via his iPad
102 T: three and +then minus?
+T points at '-7', which is part of the equation of 3(b+1)-7
103 (0.4)
104 S? minus seven
105 (0.2)

106 T: +seven (0.2) +bracket (1.1) and then +another bracket
+T writes down '-7' in black colour via his iPad
+T draws a bracket in black colour via his iPad #32
+T draws another bracket in black colour via his iPad#33

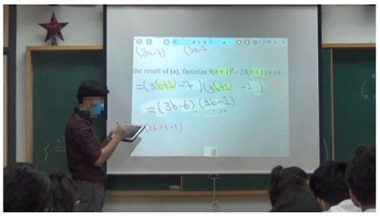


Figure #32

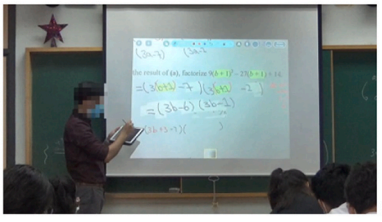


Figure #33

107 (0.8)
108 T: same thing (1.8) +three b plus three and then
+T writes down '3b+3' via his iPad in red colour #34

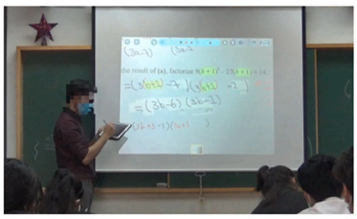


Figure #34

109 (0.7)
110 T: +minus two +(5.2) and then we have +three b
+T writes down '-2' next to '3b+3' via his iPad in black colour #35
+T crosses out S10's answer #35
+T writes down the final answer in black colour #36

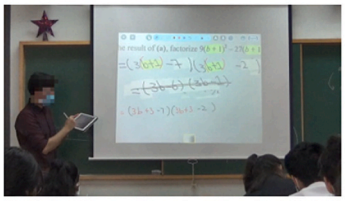


Figure #35

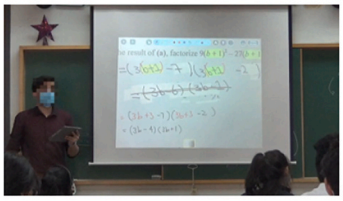


Figure #36

111 (6.2)
112 T: okay shh

pedagogical goal of using a range of technological affordances to facilitate his teaching (Table 2).

T first acknowledges that students would make mistakes when doing a factorisation question. This becomes a motivation for him to make use of the photo taking function afforded by the iPad in order to provide feedback to all students regarding the approaches to doing the mathematical question. T makes use of the iPad as a projector to capture an image of S10's work and display it on a large screen for the class to observe the student's approach to solving a mathematical formula. As indicated by the MCA analysis, T can also use gestures to direct the students' attention to specific mathematical values on the screen. It can be suggested that through utilizing the camera function, this enables T to project the student's work on the screen and expands his multimodal repertoire as he can use gestural resources to point at specific mathematical errors that are made by the student. This can construct a learning environment where students can interact with authentic material.

Additionally, it is evident in the classroom analysis that T makes use of the zoom in and out functions and different colour pens to indicate key mathematical values for the students to focus on. It can be argued that these iPad functions can be beneficial to students who are visual learners. In particular, the researcher believes that T's use of coloured pens is helpful for students to differentiate the two different mathematical terms. As emphasized by T, the use of black colour and red colour pens in providing feedback on S10's work allows him to highlight the mathematical terms that are derived from the brackets and the terms that come from S10's original steps. By differentiating the mathematical terms that come from the expansion of the bracket, the use of colours can be visually pleasing for students. This reflects T's pedagogical goals of using diverse semiotic resources to facilitate his mathematical teaching since T aims to 1) simplify the mathematical explanation and 2) promote students' learning of the mathematical approach to solving algebraic equations.

8. Discussion and conclusion

In response to the research question, this paper aimed to show the ways in which an EMI teacher's use of iPads broadens his multimodal repertoire, facilitating students' learning of both academic language and content knowledge. Particularly, it adopts translanguaging as an analytical perspective to reveal the teacher's CIC which reflects the teacher's ability in deciding the appropriate resources for enhancing the quality of students' learning experience in the classroom. It is noticeable that the EMI teacher is only using English as the named language. It can be argued that the teacher could have drawn on different multilingual resources while scaffolding students' content and language learning processes. Nevertheless, since students' English proficiency levels were deemed satisfactory by the teacher and the students do not share a common L1 with the teacher and other classmates, it can be argued that the teacher is not in a favourable position to draw on different multilingual resources for meaning-making (Ho, 2022). Additionally, as previously noted, there is a lack of research on how translanguaging takes place in monolingual EMI contexts, specifically in terms of transcending multimodal resources (Ho, 2022; Tai, 2023a; Tai & Li, 2021). While the majority of the studies on translanguaging in EMI contexts focus on instances where the monolingual English-only policy is challenged by classroom participants for achieving meaning-making (e.g. Jakonen et al., 2018), the current study focuses on how a translanguaging space is constructed within a linguistically restricted space stipulated by a monolingual policy. This study addresses the research gap by demonstrating how a teacher engages in translanguaging practices by using verbal explanations in English along with multimodal resources like gestures and iPad functions, such as zooming in and out, highlighting, and drawing in different colours to facilitate meaning-making processes in the classroom. In Extract 1, the teacher's use of translanguaging reflects his CIC and helps students understand the abstract word 'respectively' in academic discourse. In Extract 2, the

teacher uses the iPad to bridge the gap between everyday life knowledge and academic knowledge by using colours and real-life examples to scaffold students' understanding of simple fractions. In Extract 3, the teacher uses the photo-taking function to provide corrective feedback to the whole class and mobilizes other semiotic resources like zooming in/out, different colour pens, and gestures to simplify the mathematical explanation and facilitate students' learning of the algebraic equation. Overall, the iPad's affordances provide opportunities for the teacher to use multimodal resources to simplify the mathematical explanation for facilitating students' learning of the mathematical question.

Based on the IPA analysis of the video-stimulated-recall-interview, it is evident in the study that the teacher's use of the iPad is motivated by his pedagogical belief for creating a relaxed classroom atmosphere (Table 1) and supporting students' learning of adopting particular approaches for solving mathematical questions (Tables 1 and 2). The findings emphasize that the teacher's multimodal translanguaging practices are shaped by his pedagogical beliefs, including the importance of connecting mathematics to everyday life contexts (Table 1) and adopting inclusive pedagogical practices to cater to diverse students' needs (Table 2). It is essential to take these factors into account to comprehend why the teacher creates a translanguaging space for accomplishing his specific pedagogical goals in classroom talk.

Hence, I argue that adopting translanguaging as an analytical perspective can further conceptualize Walsh's notion of CIC which allows researchers to better capture the teacher's competence in tapping on a wide range of linguistic, multimodal and technological resources to construct a translanguaging classroom space that is conducive to interaction and content and language learning in EMI classroom. That is, a technology-mediated translanguaging space can be constructed in and for classroom interaction when the teacher demonstrates his/her CIC through employing technological devices as multimodal affordances for enhancing instruction and student engagement. Such an argument highlights the importance of developing a teacher's ability to make appropriate assessment of what, how and why specific linguistic and multimodal resources should be marshalled at particular moments of classroom interactions (Li, 2018; Tai & Dai, 2023; Walsh, 2011, 2013).

Moreover, this study provides further support for the concept of translanguaging, which embraces the idea that linguistic signs are just one aspect of a broader range of modal resources available to sign makers. These resources carry specific socio-historical and political associations (Li, 2018, p. 14). In this study, it can be argued that the EMI mathematics teacher reduces translanguaging to a multimodal form of pedagogical practice that does not involve students' first language (L1). This is evident in the classroom interaction data extracts, which are conducted solely in English. However, it is important to note that the goal of the study is not to determine what practices are considered good or bad in translanguaging. Rather, the focus is on the quality rather than the quantity of translanguaging practices in the process of constructing knowledge (Tai, 2023c). Therefore, the notion of translanguaging aims to challenge the traditional bias towards focusing primarily on standardized speech and writing.

The findings of this study contribute to research on translanguaging and teaching and learning of new academic and subject-specific knowledge in a number of ways. Theoretically, the study highlights the dynamic and fluid nature of translanguaging as a form of CIC for fostering the creation of a technology-mediated translanguaging space and promoting students' content and language learning. As mentioned before, research on CIC has not emphasized the dynamic movement between communicative modes and resources (Tai & Dai, 2023; Walsh, 2011). This paper illuminates that classroom interaction is translanguaging in nature and mobilizing the multimodal affordances of technological devices, such as the iPad, when interacting can play an important role in enabling teachers in constructing a technology-mediated translanguaging space in the classroom to foster students' content and language learning. Methodologically, this study showcases how adopting translanguaging as an analytical perspective in analysing the classroom data can help us to understand how the iPad functions can provide various opportunities for the teacher to publicly explain and evaluate students' ideas in order to facilitate the meaning-making processes in the classroom interactions and making learning accessible for all students (Tai, 2022). The findings can raise teachers' awareness of the multimodal affordances of the iPad and other mobile technological devices offered in order to encourage teachers to construct a technology-mediated translanguaging space for supporting students' content and language learning.

The findings have the potential to contribute to improved teaching and enhance teachers' CIC in the classrooms. While the findings presented in this study reflect the practices of the specific EMI teacher and may not directly apply to other teaching contexts, it is anticipated that these findings can provide a systematic comprehension of the choices made by the EMI teacher. This understanding can potentially inspire teachers in similar situations to explore how they can incorporate translanguaging pedagogies that align with their professional contexts. It is important to note that the study does not prescribe what other teachers should do, but rather aims to offer insights and possibilities for implementing translanguaging practices in a manner that is suitable and relevant to their specific teaching environments.

It is acknowledged that the EMI teacher may face challenges in utilizing multilingual resources to create a translanguaging space for scaffolding students' content learning. However, the teacher could have leveraged the affordances of the iPad to engage in multilingual interactions, such as using Google Translate, to facilitate multilingual translanguaging in the EMI or Content and Language Integrated Learning (CLIL) classroom (e.g., Dooly & Tudini, 2022). EMI and CLIL classrooms share similarities, as they both posit that using the second language (L2) to teach content provides authentic and meaningful contexts for L2 learning and acquisition to take place (Snow & Met, 1989). CLIL, commonly used in Europe, is defined as an educational approach that employs various language-supportive methodologies, focusing on both language and content (Coyle et al., 2010). Although the proportion may vary, Marsh (2002) suggests that CLIL programs should have a dual focus on language and content. Future research could explore how EMI and CLIL teachers could utilize their diverse multilingual and multimodal resources to create a technology-mediated translanguaging space, incorporating familiar funds of knowledge to scaffold students' content knowledge and academic language.

Moreover, this study does not present quantitative data that demonstrate the correlation between teachers' use of translanguaging in the EMI classroom and students' performance in content subjects. To establish the effectiveness of translanguaging pedagogy for content and language learning, future research could include students' assessment data to closely examine the connection between teachers' translanguaging practices and students' development of content knowledge and language acquisition. Quantitative evidence could complement and triangulate the MCA analysis, providing valuable insights into how the affordances of EMI teachers' translanguaging practices impact students' academic learning outcomes.

CRediT authorship contribution statement

Kevin W.H. Tai: Conceptualization, Methodology, Investigation, Data curation, Writing – original draft, Writing – review & editing, Project administration, Funding acquisition.

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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)
word	(underline) Emphasized word, part of word or sound
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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