Translanguaging Practices of Multilingual Teachers and Students During Face-to-Face and Online Mathematical Discourse: A Comparative Analysis

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Abstract
Hybrid learning is predicted to be the future trajectory of mathematics education. It is therefore imperative that mathematics educators reflect on current teaching and learning practices in mathematics and establish practices that will support quality mathematical discourse, whether classes are delivered in-person, virtually, or via a combination of both. To gain an in-depth understanding of how face-to-face and online mathematical discourse unfolds in class, this study borrowed a theory from the discipline of communication called translanguaging. It is the fluid, dynamic, and creative use of an individual's multilingual, multisemiotic, and multimodal repertoires as resources for communication and meaning-making. Guided by this lens, this multiple-case study investigated the resources constituting the translanguaging practices of Filipino multilingual teachers and students at the senior high school level as they engaged in mathematical discourse. Both face-to-face and online classes were observed, recorded, and transcribed using Mondada's multimodal transcription convention. A multimodal conversation analysis was subsequently performed to identify emerging translanguaging practices. Results showed that multilingual, multisemiotic, and multimodal resources were present in both face-to-face and online mathematical discourse. The languages spoken in the two settings were similar, but there were differences in the multisemiotic and multimodal resources mobilized, such as the use of body language signals by teachers and students during face-to-face mathematical discourse and the use of virtual gestures during online mathematical discourse. The findings of this study could serve as a guide for identifying and leveraging the translanguaging capacities of teachers and students to help facilitate quality mathematical discourse in both environments.

Keywords: hybrid learning, mathematical discourse, translanguaging

Introduction

Hybrid learning is predicted to be the future trajectory of mathematics education. As Borba (2021) emphasized, the COVID-19 pandemic has changed the agenda of mathematics education, especially with the emergence of digital technology. It is therefore imperative that mathematics educators reflect on current teaching and learning practices in mathematics and establish practices that will support quality mathematical discourse, whether classes are delivered in-person, virtually, or via a combination of both. To gain an in-depth understanding of how face-to-face and online mathematical discourse unfolds in class, this study borrowed a theory from the discipline of communication called translanguaging.

Translanguaging as a Theoretical Lens

Translanguaging is the fluid, dynamic, and creative use of an individual's multilingual, multisemiotic, and multimodal repertoires as resources to communicate, make meaning, and support his or her learning process (Tai, 2022; Tai & Wei, 2020; Wei, 2018; Wei & Ho, 2018). The concept of translanguaging as a communication practice can be traced back to the Welsh revitalization program, which is an initiative led by the Welsh government in its attempt to revive the Welsh language by mandating its use as a medium of instruction in schools across Wales (Williams, 1994, as cited in Wei, 2018). Welsh is the native language of Wales, but English has become the dominant language through the years. Williams observed that despite the teacher instructing the class in Welsh, the majority of the students' responses would be in English. There were also instances when the students would read the material in Welsh, but the teacher would use English to elaborate on what the students had read. This practice of switching languages is not only unique to the Welsh context but is also common among bilingual and other linguistically diverse populations. Originally termed *trawsieithu*, translanguaging was then coined as a pedagogical term to refer to the natural ways multilingual individuals utilize their languages as they make sense of the social world (Marrero-Colon, 2021; Wei, 2018).

As a pedagogical practice, translanguaging deepens engagement and makes any rigorous learning content accessible and comprehensible to multilingual learners because it allows them to communicate and construct meaning across languages (Garcia, 2013; Vogel & García, 2017). Similarly, Baker and Wright (2021) argued that translanguaging helps learners in bilingual classrooms achieve a deeper understanding of a subject matter through linguistic reprocessing. For instance, in content areas such as mathematics, translanguaging is said to support the construction of mathematical understanding of bilingual students by fostering a flexible mathematical learning space, where they can engage in mathematical discourse using their full linguistic repertoire (Garza, 2017). However, as previously stated, translanguaging also includes the use of semiotic and modal resources in its scope. This suggests that, in addition to the languages constituting one's linguistic repertoire, it is also important to recognize the role that semiotic and modal resources play in communication and meaning-making.

Even with the growing body of research on translanguaging, Canagarajah (2011) argued that the majority of studies published so far focus on face-to-face oral interactions and not much on other modalities of communication. As this study aims to investigate both face-to-face and online mathematical discourse from a translanguaging lens, it may therefore contribute to this gap in the literature. In addition, building on the ideas discussed so far, adopting a translanguaging perspective may shed light on how multilinguals, such as Filipino teachers and students, leverage their diverse resources for communication and learning of content areas such as mathematics in both face-to-face and online classrooms. In order to do so, this study seeks to compare the translanguaging practices of Filipino teachers and students during face-to-face and online mathematical discourse. In particular, it seeks to determine the similarities and differences in their use of their multilingual, multisemiotic, and multimodal resources as part of their translanguaging practices in the two settings.

Methodology

This study followed a multiple-case study design to investigate the translanguaging practices of Filipino teachers and students. The data gathering was carried out at a private senior high school in the National Capital Region (NCR) of the Philippines. Three class sections were invited to participate in the data gathering. The first class consisted of 18 students, the second had 36 students, and the third had 33 students. Both face-to-face and online mathematics classes were observed and recorded for nine (9) weeks, with each week consisting of three (3) face-to-face classes and one (1) online synchronous class. The video recordings were then transcribed using Mondada's multimodal transcription convention, taking into account all resources that emerged during the mathematical discourse. Lastly, the transcripts were examined using a multimodal conversation analysis to compare the translanguaging practices of the participants in the two settings.

Results and Discussion

The discussion that follows highlights key translanguaging practices of the teachers and students, as observed in both face-to-face and online mathematical discourse.

Face-to-Face Mathematical Discourse

Based on the analysis of the transcripts from the observation of face-to-face mathematical discourse, it was determined that both teachers and students utilized English, which is the mandated language of instruction in mathematics, and Tagalog, which is their mother tongue, as their linguistic resources for communication. They also frequently used Taglish, which is the fusion of these two languages, as a language variant. The emergence of these languages proved that even if English was the language used in the instructional materials, both teachers and students still relied on their first language to communicate with each other. This practice reflects a translanguaging approach, specifically the tendency of multilingual individuals to tap into the languages available in their repertoire to support their communication and learning.

For the multisemiotic and multimodal repertoires, both teachers and students were observed to use mathematical representations in the form of symbols, notations, and equations, among others, to represent mathematical concepts. These representations were conveyed through various modalities, such as through speech, writing, or gestures. For example, as the teachers wrote equations on the physical board, they would concurrently read the equations aloud, thereby blending visual and auditory modes of communication. Another example was their use of hand gestures while speaking, which demonstrates their simultaneous use of verbal and gestural resources. These practices were also observed among the students when they were called on to recite, highlighting the tendency of multilingual individuals to go beyond their linguistic resources and draw on non-linguistic resources as well to facilitate communication.

Online Mathematical Discourse

Based on the analysis of the transcripts from the observation of online mathematical discourse, it was determined that both teachers and students also utilized English, Tagalog, and Taglish as their languages for communication. This observation suggests that regardless of the setting, the tendency of multilingual individuals to leverage their full linguistic repertoire remains. However, one interesting observation that was not present in the face-to-face mathematical discourse was the use of the built-in chat box by the students to convey their messages in written form. Unlike in face-to-face settings, where mathematical discourse predominantly occurs through speech and writing on a physical board, the chat box provided an alternative space for students to express their ideas in writing. This additional mode of communication allowed the students to participate in the mathematical discourse even without speaking and having access to a physical board, highlighting how digital tools can expand the multimodal repertoire in online settings. Another interesting observation was the use of a virtual board by the teacher for writing, which was shared with the students through the share-screen feature of the video conferencing platform. The virtual board functioned much like a physical whiteboard, allowing the teacher to write equations and draw illustrations during the online mathematical discourse. This digital tool served as another mode of communication and as a central point of reference for both teachers and students, allowing them to integrate written and visual resources to enhance their communication and learning.

As for the multisemiotic repertoire, both teachers and students continued to use mathematical representations to refer to mathematical concepts, which they conveyed through speech and writing. They also used virtual gestures to deliver other types of information, such as the thumbs-up gesture or the heart reaction to relay their agreement. These virtual gestures may be characterized as both a semiotic and modal resource, as they functioned as signs through which the students' messages were delivered. The emergence of these virtual gestures is another example of how digital tools can support online discourse by offering an alternative mode of communication to engage the students in the discourse.

Similarities and Differences Between Face-to-Face and Online Mathematical Discourse

Table 1: Comparison Between Face-to-Face and Online Mathematical Discourse

Repertoire	Face-to-face Mathematical Discourse	Online Mathematical Discourse
Multilingual	English, Tagalog, Taglish	English, Tagalog, Taglish
Multisemiotic	Mathematical Representations	Mathematical Representations
	Physical Gestures	Virtual Gestures
Multimodal	Speech	Speech
	Writing on Physical Board	Writing on Virtual Board and Chat Box

Table 1 summarizes the similarities and differences between face-to-face and online mathematical discourse. In summary, multilingual, multisemiotic, and multimodal resources were present in both face-to-face and online mathematical discourse. The languages spoken in the two settings were similar, but there were differences in the multisemiotic and multimodal resources mobilized, such as the use of body language signals by teachers and students during face-to-face mathematical discourse and the use of digital tools, including the chat box, virtual board, and virtual gestures, during online mathematical discourse.

Conclusion

Based on the discussion, it can be concluded that both teachers and students utilized their multilingual, multisemiotic, and multimodal repertoires as resources to communicate and make meaning in both face-to-face and online mathematics classrooms. This means that regardless of the setting, multilingual individuals instinctively rely on the resources that are available to them to support their learning of mathematics. This supports the claim of Wei and Ho (2018), who stated that multilingual learners naturally leverage and orchestrate their diverse resources during their process of learning.

Considering the role that translanguaging plays in facilitating mathematical discourse, the next step of the authors then is to determine whether or not an association exists between the translanguaging practices of the students and their learning outcomes in mathematics. The purpose of this is to determine whether the use of translanguaging impacts students' academic performance, and if so, to gain insights into how translanguaging may enhance their learning processes and outcomes, as well as to identify potential strategies for its effective integration in both face-to-face and online classrooms. This study is therefore a subset of a larger, ongoing investigation into translanguaging in mathematical discourse. The findings presented in this paper reflect the results of the initial stage of the research.

Finally, as hybrid learning continues to grow in demand, the authors hope that the insights offered by this research could serve as a guide for identifying and leveraging the translanguaging capacities of teachers and students to help facilitate quality mathematical discourse in both face-to-face and online environments.

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