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Multimodal codemeshing: Bilingual adolescents' processes composing across modes and languages

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ABSTRACT

With the growing linguistic diversity in today's classrooms, recent scholarship has begun to explore how multilingual students can use the full range of their linguistic repertoires when composing. At the same time, conceptions of writing have expanded to include multiple modes (e.g., text, images, sound, and movement). Addressing these tandem needs, this study examined how three bilingual eighth grade students composed across multiple languages and modalities – a process we call multimodal codemeshing – when creating a digital project. This comparative case study integrated translanguaging and social semiotics theoretical frameworks to understand students' multimodal codemeshing processes. Data sources included screen capture and video observations, student design interviews, and multimodal products. Findings revealed that students initiated their multimodal codemeshing processes through exploring the composing tool, collaborating with peers, and visually brainstorming. The process involved simultaneous iterative motion on multiple levels, including across modes, phases of the process, and sections of their projects. Students exhibited a range of textually-driven and visually-driven processes for creating content and followed unique compositional paths. Furthermore, students used their heritage languages for different purposes during the composing process. Along with becoming more fluent with digital tools and modes, students described increased comfort in using and sharing their heritage languages.

1. Introduction

With the growing linguistic diversity in today's classrooms (NCES, 2016), recent scholarship has begun to explore how bilingual students can use the full range of their linguistic repertoires when composing. Translanguaging pedagogies (Canagarajah, 2011; Cummins, 2005; García & Wei, 2014), or instruction that challenges boundaries between languages in the individual and boundaries between languages in classroom use, suggest the affordances associated with accessing, leveraging, and meshing multiple languages in different parts of the composing process. These affordances range from developing understandings of genre and voice (Martínez, 2010), planning and drafting (Velasco & García, 2014), to negotiating meaning with the reader (Canagarajah, 2011). Rather than bracketing off English in instruction (García, 2009), translanguaging pedagogies emphasize the productive ways that students and their teachers can use multiple and varied linguistic resources to support their literacy development (Working Group on ELL Policy, 2009).

At the same time, conceptions of writing in today's society have expanded with the digital horizon. Composing with digital tools

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often involves the fluid orchestration of multiple modes (e.g., writing, visuals, sound, movement) to create synergistic messages for a variety of authentic audiences. Multimodal composition disrupts the linear, static, and bounded constraints of written text to involve dynamic, interactive, and hyperlinked formats (Merchant, 2007). Research demonstrates that a growing majority of youth (Rideout, Foehr, & Roberts, 2010) compose multimodally outside of school to express themselves and connect with others (Ito et al., 2010).

These shifts in pedagogy towards an expanded view of language and literacy emphasize an understanding of the learner who is both a critical consumer and a skillful producer of digital multimodal texts (Dalton, 2012). New policy initiatives reflect this view, stressing the need for all students to be able to communicate with multiple and diverse audiences and to use 21st century technologies to facilitate this process (e.g., in the U.S. context, Common Core State Standards National Governors Association Center for Best Practices [NGA Center] & Council of Chief State School Officers [CCSSO], 2010). While research has begun to show the communicative potential of leveraging multiple languages and modalities in students' digital products, there is a paucity of research showing how students move across languages and modalities during the composing process (however, see Toohey & Dagenais, 2015). For researchers and educators who seek to understand and then hone students' abilities to access and leverage the full range of their meaning-making toolkits, examining these processes is an urgent need.

With the lens that product and process are always interconnected and part of an ongoing negotiation of meaning with the reader (Canagarajah, 2011, 2013), we explore how students leverage and mesh multiple languages and modalities – a process we call *multimodal codemeshing* (Pacheco & Smith, 2015) – when creating a digital project during a literature unit. We describe these processes as part of multimodal composition, acknowledging that different modalities have unique communicative affordances (Kress, 2010) that can be amplified when juxtaposed. We also describe this process as part of codemeshing, or how individuals strategically use and mix multiple languages and modalities within written texts (Canagarajah, 2011, 2013). While work in both translanguaging and codemeshing has consistently described these practices as multimodal (see Fraiberg, 2010; García & Wei, 2014), we use the term *multimodal codemeshing* to emphasize the digital nature of using multiple languages and modalities in students' composing processes, and to distinguish this work from studies of L1 use in L2 writing processes and products (i.e., Keck, 2006; Wang & Wen, 2002). Building on Atkinson et al.'s (2015) arguments and Canagarajah's (2011, 2012, 2013) work with translanguaging practice, we view multimodal codemeshing as the use of multiple languages and modes in composing processes and products, where composers draw upon and mesh semiotic resources with varying degrees of intentionality (Dalton et al., 2015) and awareness to negotiate meaning with a reader.

In this study, we examine the multimodal codemeshing processes of three eighth grade students in the Southern United States who leveraged resources in English, Spanish, Bahdini, and Vietnamese when composing with text, visuals, sound, and animation in a digital environment. Our study is guided by the following research questions:

1. What are eighth grade bilingual students' multimodal codemeshing processes?
2. How do bilingual students use their heritage languages during the multimodal codemeshing process?

Through comparative case methods (Stake, 2006), the goal of this study is to provide insights into the complexity and variation of students' processes as they compose across modes and languages.

2. Theoretical framework

Translanguaging (Canagarajah, 2011; Garcia, 2009) and social semiotics (Halliday, 1978; Hodge & Kress, 1988) lenses guide our understandings of multimodal codemeshing processes.

2.1. Translanguaging in writing

We build on theories of translanguaging to describe how students leverage multiple resources from an integrated language system, and how this leveraging is responsive to interlocutors and contexts of use. Translanguaging suggests that an individual's semiotic resources are part of one holistic repertoire that the individual can strategically draw upon as communicative contexts change (Canagarajah, 2012; Garcia, 2009). In students' written products, these varied and often divergent linguistic resources can be deployed for a variety of purposes, such as aligning the author with specific discourse communities (Velasco & García, 2014), conveying nuances in meaning (Martínez, 2010), engaging multiple audiences (Pacheco & Smith, 2015), and amplifying an author's intended message (Stille & Prasad, 2015).

Though research in multilingual writing has described the ways that a students' first language can support or interfere with writing processes in a second language (for a review, see van Weijen, van den Bergh, Rijlaarsdam, & Sanders, 2009), we position translanguaging in writing as an author's purposeful leveraging of semiotic resources from this integrated language system. Recent work has suggested the communicative potential of codemeshing, especially within digital contexts and in conjunction with other modalities. Hinrichs and White-Sustaíta (2011), for example, explored translanguaging within email writing at the graphemic level, showing how individuals can use non-standard spellings of words in English and Jamaican-Creole to challenge reader's attitudes about language prestige. Canagarajah (2011) investigated translanguaging at the phrasal level and showed how meshing Arabic, English, and text symbols could express students' voice and identities, as well as promote reader engagement. Sebba's (2013) analysis of a multilingual and multimodal text, a poster written in Greek and English, showed how translanguaging can engage multiple readers of different linguistic proficiencies simultaneously as they engage with an entire assemblage of modalities and languages.

This research suggests the communicative potential within multilingual and multimodal products. Framing this composition as

translanguaging, however, also demands an examination of how students use multiple languages within the composing process. An individual's linguistic resources are never “unbidden” (Canagarajah, 2011; p. 401). As composing tools, interlocutors, and goals for communication change, so do the linguistic resources used to negotiate meaning. Examining the composing process – or the iterative, responsive, and strategic practices used by individuals when creating texts – can offer much needed insight into how individuals move across modalities and languages to begin meaning negotiation with a real or imagined reader. In other translanguaging activities, for example, this movement can be afforded and constrained by language ideologies in the classroom context (Martínez, Hikida, & Duran, 2015), the linguistic proficiencies of the composer's imagined or real audience (Canagarajah, 2011), and the material constraints of the compositional tools at hand (Toohey et al., 2015). Martínez-Roldán (2015), for example, suggests that implicit monolingual goals within bilingual activities can constrain productive student translanguaging. Similarly, Rowe and Miller (2016) found that the language use of different members of the classroom community played an important role in affording students' productive written and oral translanguaging. These studies of translanguaging emphasize that languages are not separate within the individual, and likewise, that language is never separate from contexts of use (Pennycook, 2010).

In sum, understandings of translanguaging in writing suggest that an author can integrate multiple languages within products for a range of communicative affordances. However, as contextual features change, how these languages are leveraged vary throughout the composition process. We echo van Leeuwen (2015), who cautions against romanticizing students' multimodal composing, and argue that translanguaging demands a close examination of students' processes where they consider the different rhetorical capabilities of meshing languages and modalities, navigate multiple language ideologies, and begin to negotiate meaning with real and imagined readers in specific composing contexts.

2.2. Multimodal composing processes

We also draw upon a social semiotics (Halliday, 1978; Hodge & Kress, 1988) framework that emphasizes how all meaning-making is multimodal, including linguistic, visual, aural, gestural, and spatial elements, which are in dynamic interaction with one another during communication. Meaning occurs through the complex interaction between different modes, and the unique interweaving of modes communicates generative messages that no single mode communicates on its own (Jewitt, 2009). Multimodal scholars have examined the intersemiotic relationships between modes, including analyzing how modes can align to emphasize a complementary message (Dalton et al., 2015; Smith & Dalton, 2016) or diverge to create dissonance and convey different messages simultaneously (Unsworth, 2006). Orchestrating multiple modes can create distinct opportunities for multilingual students to leverage cultural and social capital in response to texts (Bailey, 2009; Smith, 2014), to express identities in ways not typically afforded by written texts (Hull, Stornaiuolo, & Sahni, 2010), and to “braid” home literacy practices with school practices to craft and develop multilingual narratives (Zapata, 2014).

Social semiotics also elucidates how modes are shaped by sociocultural factors that influence how they are employed in communication. A mode is imbued with histories, as well as communicative and material affordances for constructing meaning. These affordances of a mode offer potentials that make it better for certain communicative tasks than other modes (Kress, 2010). Smith (2016) found that students often demonstrate and express different modal preferences for how they choose to communicate. For example, an adolescent might be able to express personal emotions visually in a way that is not possible through writing, whereas another student might prefer to rely on the specificity of linguistic modes to convey their message.

The majority of multimodal composition research emphasizes the benefits of such practices for fostering student engagement, identity expression, and agency – particularly for culturally and linguistically diverse students. However, only a few studies (Bruce, 2009; Dalton & Smith, 2012; Fraiberg, 2010; Gilje, 2010; Ranker, 2008) have closely examined the actual process of composing with multiple modes – finding it a collaborative, iterative, and mediated process.

Research that closely examines the multimodal composing process illustrates it as recursive and involving the layering of modes (Bruce, 2009; Dalton & Smith, 2012; Smith, 2016). Bruce (2009) found that high school students composed in a nonlinear fashion when creating digital videos. Students overlapped the videotaping and editing processes – often beginning to edit while still filming other parts of their video. As a result of his findings, Bruce (2009) developed a video composition process model conceptualized as a continuum on which composers recursively shuttled back and forth between visually conceptualizing ideas they wanted to videotape and evaluating how they would go about creating those ideas.

In addition to being a nonlinear process with iteration across composing stages, Dalton and Smith (2012) described how there was also modal recursion – between images, sound, movement and text – when two adolescents created a video folktale retelling in a summer digital workshop. The pair layered modes beginning with image, followed by audio narration and then music, and ending with typing opening title and credits. The students also exhibited iterative movement within and across scenes of their folktale by jumping around their story and composing in two-scene chunks. Their study and the work of others (Gilje, 2010; Ranker, 2008) underscores the importance of digital tools for mediating multimodal composing processes.

Smith (2016) conducted a comparative analysis with urban 12th-grade students composing across three distinct multimodal projects in response to literature. Through the development of multimodal composing timescapes, findings revealed that students' rapid traversals of modes were mediated by the convergence of the digital tools, multimodal genre, and students' modal preferences and skills. For open and flexible composing tools (e.g., PowerPoint and website programs), where modes could come into contact in endless ways, students exhibited similar composing patterns and often relied on the same mode (e.g., visuals or writing) for entering the process and building new content. Additionally, students viewed their preferred modes as carrying unique affordances (Kress, 2010) for communicating their creative vision.

As of yet, very little research has closely examined the composing processes of students who work with both multiple modes *and* multiple languages in digital environments, a goal of the current study.

2.3. Multimodal codemeshing as translingual practice

We frame multimodal codemeshing as *translingual practice* (Canagarajah, 2012), or an activity in which a composer draws on multiple semiotic resources to negotiate meaning with real or imagined readers. We understand multimodal codemeshing as a means for this composer to address a “diverse range of readers’ social positions and ideological perspectives” (Horner, Lu, Royster, & Trimbur, 2011, p. 307), and we emphasize that this negotiation of meaning is evident in both the process and product. Just as the reader negotiates meaning from the semiotic resources articulated within the written product, the composer makes decisions about language and modalities in the composition process as they consider how these semiotic resources might accurately represent identities and interests, how they might establish a shared context with the reader, and how they might build consensus with the reader about different textual interpretations (Canagarajah, 2013). This framing accounts for the ways that students’ linguistic and multimodal resources relate to the contexts in which they are deployed. As Leonard (2014) observed, whereas work has begun documenting *what* resources students have at their disposal, more work needs to address *how* these resources are used in activity.

To summarize, we seek to understand how bilingual students strategically draw on multiple languages, images, music, voice recordings, animations, and other design features to make meaning during the multimodal codemeshing process. Unlike past work that has investigated the affordances and constraints of using the L1 to support L2 writing or the use of multiple modes in the writing process to support text-based products, we specifically attend to the ways that students orchestrate multiple languages and modalities in their composition process as they then make use of these same resources to negotiate meaning with a reader in their composition products.

3. Methods

To address this underdeveloped area of research, comparative case methods (Stake, 2006) – which analyze similarities, differences, and patterns across multiple cases – were employed to understand adolescents’ multimodal codemeshing processes.

3.1. The setting and participants

This study was conducted in one eighth-grade English class at an urban school in a major city in the Southern United States, with 26% of the students at the school designated as English language learners (ELLs) and 96.1% receiving free or reduced-price lunch. In the classroom, all of the 28 students were proficient in speaking languages other than English, which included Spanish, Mandarin, Pashto, Thai, Vietnamese, Arabic, Bahdini and Sorani (Kurdish languages), and Mushunguli (a Somali language). All students in the class were either receiving ELL services or were formerly designated as ELLs.

Through purposeful sampling (Patton, 1990), three focal students were selected from this class for in-depth analysis of their multimodal codemeshing processes. Focal students were selected based on conferrals with the teacher (Ms. Lancaster; all names are pseudonyms), initial researcher observations, and student interest surveys. We chose students to represent variation in heritage languages, proficiencies in these languages (as reported by the students), proficiencies in English (as identified by state assessments), academic abilities (as reported by the teacher and state assessments), class engagement, and experience with technology. We use the term *heritage language* to denote languages that students use with their families or communities that are tied closely to their cultural heritage (Fishman, 2001). We emphasize that these languages were not necessarily a students’ first or home language, or the language in which students were most proficient, as bilingual individuals often continue to develop multiple languages simultaneously. All participants in this study, including students and their parents/guardians, provided informed consent/assent. In the following, we provide background information for each focal student.

3.1.1. Yuliana

Born in El Salvador, Yuliana (15 years old) had only lived in the United States for two years at the time of the study. According to Yuliana, she was advanced in Spanish and state assessments showed she had limited proficiency in English. At home, she spoke English with her stepfather and Spanish with her mother – often serving as a language broker and translator (Orellana & Reynolds, 2008). At school, Yuliana spoke Spanish with her friends and was usually reserved during class time. She was a dedicated student who was a deep thinker. Conscientious about her grades, Yuliana viewed “knowledge [as] power” and “never want[ed] to stop learning until the day [she] died.” Yuliana had a computer at home, but was “not allowed to touch it.” As such, she exhibited limited technological proficiency.

3.1.2. Kasim

Kasim (14 years old) was born in the United States and his family was from Iraq. He reported being advanced in his heritage language, Bahdini, and demonstrated intermediate proficiency in English according to state assessments. At home, Kasim spoke Bahdini with his father and brother and Sorani with his friends. Kasim was proud of his heritage and spoke about wanting to use Bahdini in school and eventually move back to Kurdistan. He had access to a computer at home and used it for communicating on social media. Outspoken and wanting to be perceived as “funny” by his peers, Kasim sometimes appeared as the “class clown” and as though he did not take school seriously.

3.1.3. Becca

Born in the United States, Becca (14 years old) lived with her Vietnamese mother and her older brother. She reported that she was intermediate at speaking Vietnamese, and she was advanced in English according to state assessments. At home, Becca spoke Vietnamese with her mother and English with her brother. She expressed hesitation about speaking Vietnamese in school because “people laugh and generalize.” Becca strove to achieve in class and was well-liked among her peers. She admitted having access to a computer at home; however, it did not have the same programs that were used in class (e.g., PowerPoint).

3.2. “My Hero” multimodal project

Students participated in a 4-week literature unit connected to the anchor text, *The Warrior’s Heart* (Greitens, 2012), a memoir featuring stories of a commander in the U.S. Navy’s humanitarian work across the world. The culminating project was a multimodal presentation where students chose a person in their life who they considered a personal hero. The first phase of the assignment required students to conduct and record an interview with their hero – with many choosing to speak in their heritage languages. Next, they used PowerPoint to create a multimodal presentation that provided background information of their hero, synthesis of their interview, connections to the novel, and personal reflections. According to Ms. Lancaster, there were several purposes for this assignment, including for students to (a) make personal connections to the novel by telling the story of a hero in their life, (b) reflect on themes of heroism in the novel, (c) gain technical skills, and (d) learn to express themselves through multiple modes in digital environments. As many of the heroes students interviewed did not speak English, students chose to use other languages in their digital products. Ms. Lancaster encouraged students to use languages other than English in their digital products; however, no direct instruction was given on how to integrate them nor did Ms. Lancaster speak in other languages during class time.

The class participated in a Scaffolded Digital Writer’s Workshop (Dalton, 2012), which supported students in seeing themselves as “designers” and understanding how multiple modes can be used for expression. This workshop model also focused on developing a supportive class community where students shared their work and relied on one another as resources.

Throughout the workshop, students were provided explicit instruction on how to use PowerPoint and other technical skills (e.g., recording their voices, editing images). They were shown why and how a multimodal project was created, and examined teacher-generated and real-world examples that made clear the various design decisions a composer could make. Students also had multiple opportunities to share their work, both in class (e.g., whole-class presentations, gallery walks, and peer workshops) and with a larger audience in a project showcase that included their classmates, as well as students and teachers across their grade level, at the conclusion of the unit.

The composing process was purposefully scaffolded so that students had freedom in how they used modes and digital tools. Students were not instructed to write elements of their project first or storyboard before using non-textual modes. The composing process was left open so students had multiple entry points and could follow any individualized preferences for creating their projects (see Smith, 2016).

As participant observers, we collaborated with Ms. Lancaster to apply the workshop model to align with her unit goals and helped develop curricular materials. Although we assisted with technical aspects and some student questions, our main focus in the classroom was on collecting data. Ms. Lancaster remained the lead teacher of the class; however, her role often shifted to facilitator during in-class workshops. She constantly walked around to provide just-in-time support for individual students who had questions about the assignment or tools, or wanted feedback on elements of their projects. Occasionally, she would provide a brief mini-lesson to the class if she noticed multiple students had a similar technical issue or question during work time.

3.3. Data collection

Data from multiple sources were collected and triangulated to construct a multifaceted understanding of multimodal codemeshing processes.

3.3.1. Computer screen recordings

During the eight in-class workshops, each student used laptops with Camtasia software to record screen movements. This software tracked the actions of students’ mice, websites visited, content of their writing, and all media used and edited. The screen recordings also captured accompanying audio during the compositional process, which provided insights into any self-talk or verbal interactions during workshop time.

3.3.2. Video observations

Focused observations (Patton, 1990) were conducted with the three focal students via videotaping and taking field notes. Students’ desks were arranged in a cluster of five seats facing each other (3 focal students and 2 peers in the group). Since Camtasia recorded their screen activity and audio during workshops, video cameras were placed towards students to record their faces, bodies, and interactions. These observational data collected during workshop time also provided perspective into affective reactions or other in-the-moment elements of multimodal composing that might not be apparent through computer screen recordings alone.

3.3.3. Design interviews

Students participated in 45-min semi-structured design interviews (Dalton et al., 2015) after their projects were completed. The purpose of these interviews was to learn more about students’ modal designs, heritage language use, and perspectives on their

codemeshing processes. Students were shown their multimodal products during the design interview on a laptop so they could point out specific elements of their work and reasoning behind design decisions. Camtasia screen recording connected students' verbal descriptions to elements of the projects they discussed. We also asked students about what work, if any, was completed outside of class. All design interviews were transcribed.

3.3.4. Artifacts and materials

Along with the final multimodal projects each focal student submitted, we collected artifacts related to their multimodal projects and process (e.g., graphic organizers and notes).

3.5. Data analysis

Qualitative data analysis was an iterative process that involved three phases.

3.5.1. Phase 1: open-coding

Based on Grounded Theory (Strauss & Corbin, 1998), we analyzed screen capture data, video observations, interview transcripts, and multimodal projects. This process of disassembling and reassembling the data (Charmaz, 2000) involved several rounds of open coding across these data sources to distinguish initial themes in students' multimodal codemeshing processes.

We first focused analysis on one student at a time (Stake, 2006) by creating time-stamped logs for each of their screen-capture videos. Moving sequentially through the workshops, we recorded students' compositional actions, and instances of multimodal and heritage language use. Next, we openly-coded (Strauss & Corbin, 1998) design interviews. Students' explanations of their process were compared to the process data, and we looked for new insights provided by student perspectives.

3.5.2. Phase 2: multimodal codemeshing timescapes

Once we gained an understanding of general patterns across multimodal codemeshing processes, we returned to the screen capture data to conduct a fine-grained analysis of students' specific use of modes and languages. This process involved coding all screen capture videos ($n = 22$) for on-screen activity and indicating the predominant mode composers worked with and duration of time. We also coded for all instances where students spoke, wrote, or read in heritage languages. During this axial stage of coding (Strauss & Corbin, 1998), we continually refined our coding scheme as we examined screen capture video. Twenty-five percent of screen capture data were double coded and an inter-rater reliability of 91.8% was achieved. Any coding differences or questions were resolved through discussion. Table 1 provides a description of the modal codes developed during this stage of analysis.

Finally, we expanded upon Smith's (2016) multimodal composing timescape method to create fine-grained representations of each student's use of modes and languages. We developed *multimodal codemeshing timescapes*, which served as an analytic tool and visual display for each student's process for each class workshop. These were created manually so that each timescape bar represented the sequence and proportion of time students used specific modes and languages. Timescapes were color-coded to display students' processes and compositional patterns.

Table 1

Screen capture codes for multimodal codemeshing timescape.

Screen Capture Code	Code Description
1. Image search	<ul style="list-style-type: none"> ● Searching for images online ● Reviewing images online or in files the student brought ● Downloading images
2. Image design	<ul style="list-style-type: none"> ● Formatting (e.g., changing the size, color, effects) or remixing images (e.g., collaging multiple images)
3. Text type and revision	<ul style="list-style-type: none"> ● Typing text for the project in documents or composing tool ● Revising and repositioning location of text
4. Text design	<ul style="list-style-type: none"> ● Customization of text (e.g., color, font size, font style) and other visual effects
5. Audio search	<ul style="list-style-type: none"> ● Searching for audio (music or sound effects) online or in files (e.g., interview data) the student brought to class ● Downloading audio
6. Audio remix	<ul style="list-style-type: none"> ● Use of composing tools to alter the length or sound of music
7. Voice record	<ul style="list-style-type: none"> ● Recording voice ● Verbally practicing voice recording
8. Voice remix	<ul style="list-style-type: none"> ● Customization of voice recording
9. Transitions	<ul style="list-style-type: none"> ● Inserting transitions or animations in PowerPoint
10. Heritage language use	<ul style="list-style-type: none"> ● Student writes, speaks, or reads in their heritage language
11. Informational Internet search	<ul style="list-style-type: none"> ● Searching for related resources and information
12. Project review and sharing	<ul style="list-style-type: none"> ● Reviewing project at various stages of completion ● Showing project to peers or teacher
13. Other	<ul style="list-style-type: none"> ● Stepping away from their laptop or activity during workshop time that is not related to project creation (e.g., checking email)

Table 2
“My Hero” project elements.

“My Hero” project element	Yuliana	Becca	Kasim
Heritage language	Spanish	Vietnamese	Bahdini
Project focus	Mother’s heroic journey from El Salvador	Mother’s heroism in raising her family alone	Father’s heroism moving from Iraq
PowerPoint slides	10	10	10
Total written words	564	691	400
Written words in heritage language	143	3	7
Images	15	17	12
Songs	1	1	1
Slide animations	8	16	11
Total voice recordings ^a	4	4	2
Voice recordings in heritage language	4	4	2

^a Voice recordings by either the student or their “hero”.

3.5.3. Phase 3: comparative case analysis

Comparative case analysis (Stake, 2006) involved analyzing the individual themes and patterns for each focal student and then employing axial coding (Strauss & Corbin, 1998) once again to generate overall themes for the multimodal codemeshing processes across all three cases. This process required not only looking for similarities, but also noting unique compositional differences amongst students.

3.6. Trustworthiness

We sought to establish trustworthiness through triangulating different sources and methods, conducting member checks with participants, and seeking disconfirming evidence (Erlandson, Harris, Skipper, & Allen, 1993).

4. Findings

The following findings are organized by the two guiding research questions. First, we present key similarities and differences in how eighth grade emergent bilingual students composed across multiple modes and languages. Then, we describe how students used their heritage languages during the multimodal codemeshing process.

4.1. Bilingual students’ Multimodal codemeshing processes

Students’ multimodal codemeshing processes were complex, iterative, and varied. When composing across the eight in-class workshops, students continuously traversed multiple modes and languages and followed unique compositional paths. As depicted in Table 2, Yuliana, Becca, and Kasim drew upon an assortment of modes and media – including written text, visuals, voice recordings, music, and slide animations – to construct their “My Hero” projects.

The following section details main findings across students’ multimodal codemeshing processes.

4.1.1. Launching into the multimodal codemeshing process through exploring, sharing, and visual brainstorming

Students initiated their multimodal codemeshing process by first becoming acquainted with various features of the composing tool. While this “messaging about” (Ito et al., 2010) phase included students’ developing technical expertise, it also provided opportunities to consider different communicative affordances associated with these tools. Students devoted time to clicking through each of the editing options in PowerPoint, experimenting with how to do new things, and then deleting their trial work. For example, Becca sampled 113 different slide background and color combinations within the first couple minutes of her process. Similarly, Kasim spent time clicking on different font and transition options to see their effects without deciding on any for his project. When choosing a background style for his introductory slide, he asked Becca to show him the myriad options she had discovered earlier, which he then sampled.

As students observed those around them and solicited feedback, they had opportunities to continue developing composing expertise and what Leonard (2014) calls *rhetorical attunement* – or an understanding of the affordances for different semiotic resources for negotiating meaning. The arrangement of laptops and seats – with students in small groups facing each other – spatially opened up possibilities for monitoring one another’s work and gathering ideas. Kasim was frustrated on the first day because he “was stuck” and “didn’t know what to say.” At one point, he glanced at Becca’s laptop where he could see she was successfully working on her introductory slide. Kasim asked her for assistance on his title – “I don’t know what to put. Should I do this? How about this sentence?” – and Becca offered an idea to engage his audience by including an image of the Kurdish flag. Similarly, Kasim provided feedback on Becca’s use of Vietnamese, first recognizing it as “funny” and then as “cool.” The collaborative nature of the composing process allowed students to assess different rhetorical functions associated with languages and modalities, as well as share expertise on editing sound clips, animating texts, collaging text with images, and searching online for open access images.

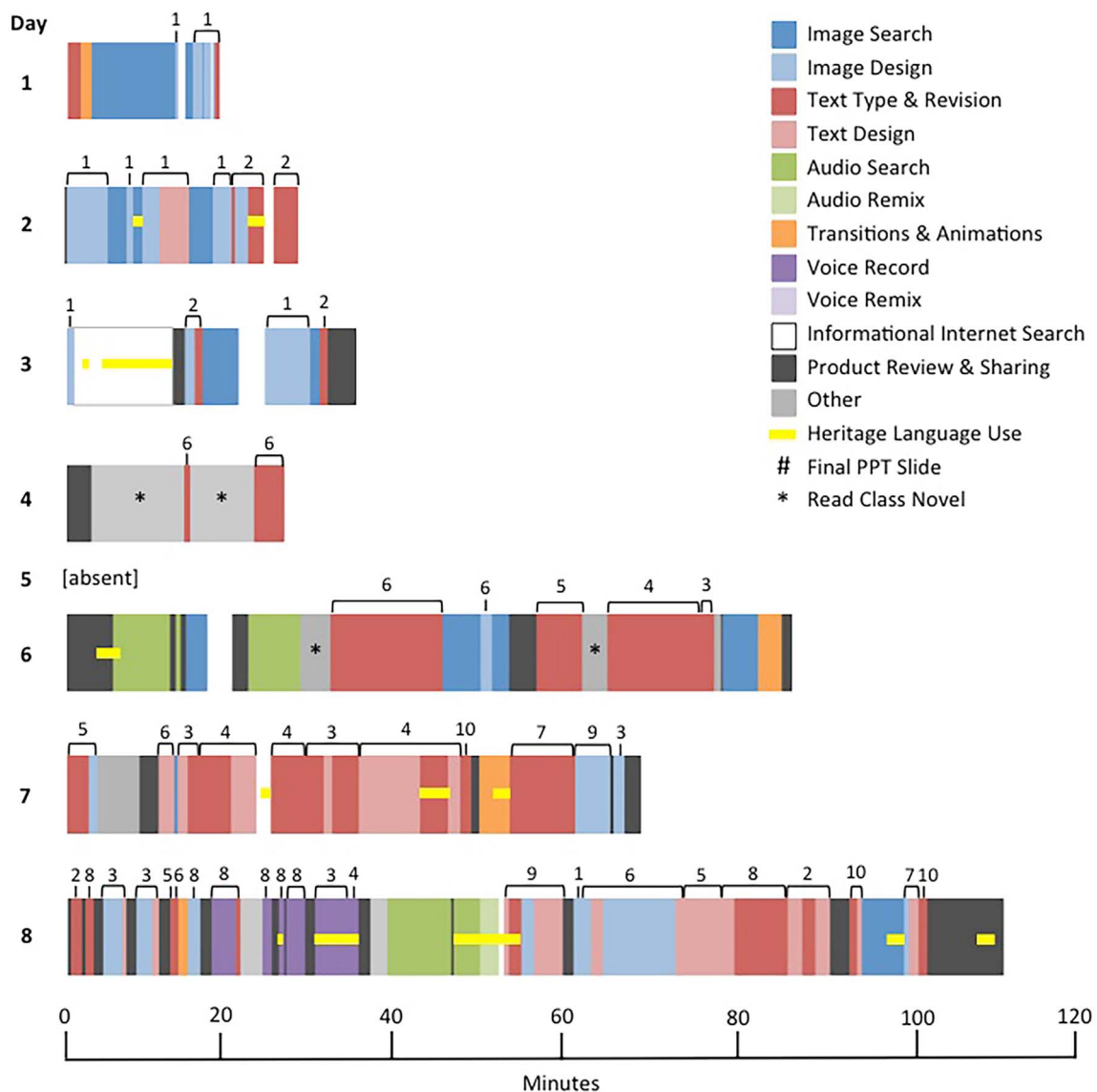


Fig. 1. Multimodal codemeshing timescape for Yuliana's "My Hero" project.

In this exploratory phase, students began to gather information and structure their presentations through *visual brainstorming*. Each student spent the majority of time on the first day searching for images and considering different visual options. This phase was initiated by using broad search terms that connected to their hero's home country: Yuliana first searched for "El Salvador," Becca for "Vietnam," and Kasim for "Kurdistan Zaxo." From there, they slowly scrolled up and down the search results and began selecting different images for possible inclusion. This phase served as productive time for students to envision the content and aesthetic of their projects.

4.1.2. Multilevel iterative process to construct meaning

After this exploration phase, students became increasingly more fluent with multimodal codemeshing. As depicted in each timescape presented below, the frequency and rapidity by which students traversed multiple modes progressed over time. Iterative movement during the process occurred simultaneously across different levels – including at the modal level, compositional phases, and sections of the final product.

Students increasingly composed with multiple modes to create their "My Hero" projects. To illustrate, Yuliana, who had limited experience with PowerPoint, quickly navigated across text, images, sound, and transitions – while also switching between English and Spanish – throughout her composing process (see Fig. 1). Yuliana's codemeshing dexterity was particularly evident during the last in-class workshop (117 min) when she wrote new sections of her project on five slides and edited the writing on six slides, searched for and edited images on six slides, and inserted transitions for six slides. With compositional freedom, she quickly traversed

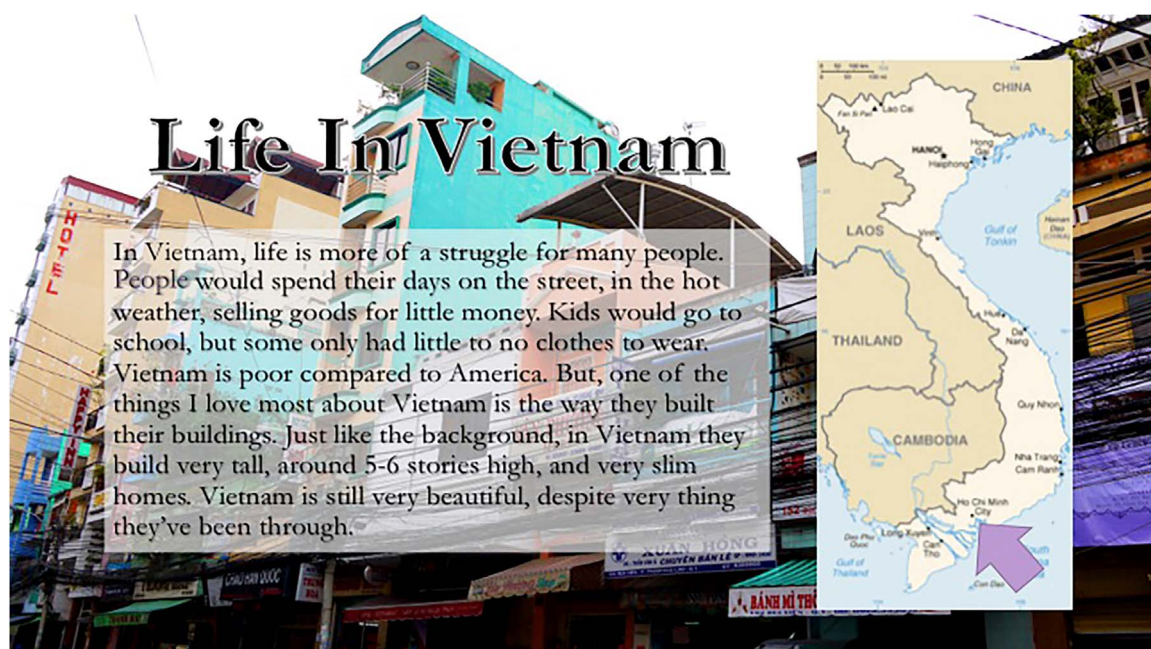


Fig. 2. A slide from Becca's multimodal "My Hero" project.

text, visuals, sound, and movement modes a total of 19 times during the final workshop to complete her project. Similarly, she nimbly moved across languages on this last day, including Spanish when searching for a song and image to incorporate, recording her voice in Spanish for three slides, composing and editing written texts, and speaking with a peer in Spanish.

Not only were students able to skillfully traverse modes and languages, but they also followed an iterative, nonlinear pattern for constructing content across PowerPoint slides. The timescapes reveal that students often followed a sequential progression during the first workshops; however, over time they jumped between different slides and continuously circled back to earlier slides to insert new content and add revisions. For example, when Yuliana composed during the final workshop (see Fig. 1), she spent the first 20 min of class working with text, images, transitions, and sound in the order of slides 2, 8, 3, 5, 6, and then back to 8. This recursive process continued during the workshop and was also apparent for Becca and Kasim, who progressively moved between modes to create their projects in a nonlinear motion across slides (see Figs. 3 and 5).

This constant movement within processes demonstrated how students made meaning between modes, languages, and sections of their projects. Students did not layer modes in a strict sequence. Instead, they often toggled between languages, text, visuals, sound, and movement when creating a slide, and continually reviewed their designs to understand how modes worked together. Becca, for example, began creating her second PowerPoint slide during the second workshop (see Fig. 2). As demonstrated in the codemeshing timescape (see Fig. 3), she repeatedly alternated between image searching (sometimes using Vietnamese keywords), image editing, and writing for that slide. In fact, she traversed these modes a total of 11 times in a span of 22 min. This quick compositional movement between modes on the same slide allowed her to see how meaning was produced across modes and how image and text generatively built upon one another.

In sum, the multimodal codemeshing process was gyroscopic in nature, involving simultaneous motion on different interacting levels. Students traversed modes, they switched between English and their heritage language, and they iteratively moved across different parts of their projects. The timescapes elucidate how cross-modal movement often increased with time as students became more comfortable and skilled with multimodal codemeshing. The dynamic process allowed students to build meaning amongst and between modes in their compositions. Multimodal codemeshing was a complex process that involved new cognitive demands for students. Yuliana explained that the process "made [her] brain do more stuff, like more thinking than [she] usually [did]" with traditional writing assignments.

4.1.3. Unique modal paths for constructing content

Despite these similarities in the multimodal codemeshing process, students used visuals and text in different ways to forge unique modal paths when creating their "My Hero" projects.

Yuliana demonstrated a visually-driven process. For the first two in-class workshops, she primarily focused on gathering images and designing a collage for her introductory slide (see Fig. 4). The six images she chose represented important aspect of her mother's journey, including images of child soldiers, national symbols, and cuisine typical of El Salvador. This preliminary phase of gathering images also served as a structural blueprint for the remainder of Yuliana's project, with her reusing each image as the background for six subsequent slides. Similar to Wessel and Herrera's (2014) findings about images serving as scaffolds or "bridges" for student text compositions, Yuliana explained why she first focused on visuals and how she incorporated subsequent modes:

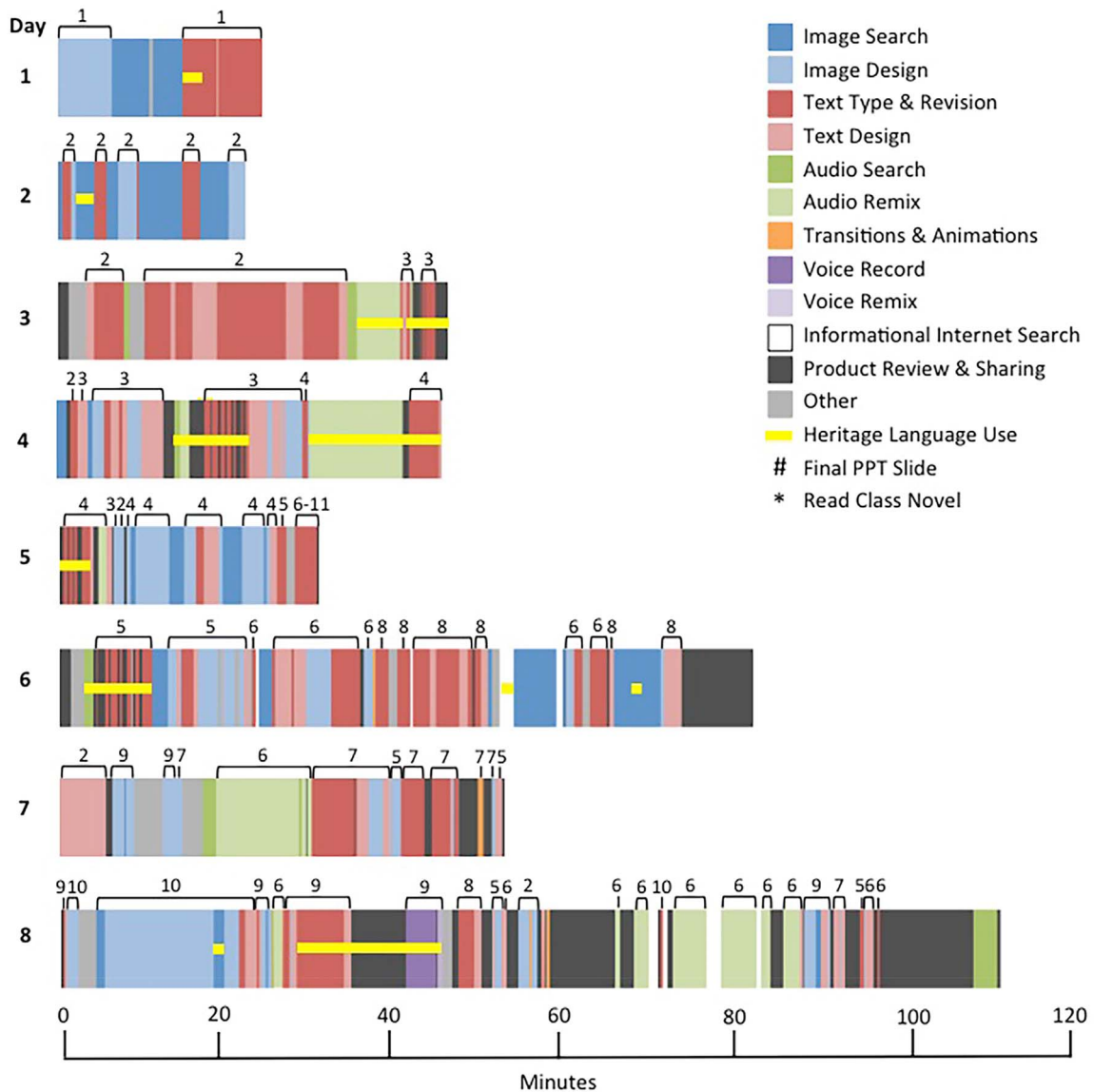


Fig. 3. Multimodal codemeshing timescape for Becca's "My Hero" project.

First, I put the pictures because I already knew what I was going to write about in the pictures, so I just put them there [in the introduction slide] and then I wrote. I did some research about the war, and everything, and then I wrote my own opinions and my mom's words, and everything. I tried to make the connection with *Warrior's Heart*, and tell about what my mom did, like how she come here, what was her childhood, and what did I learn about her.

Yuliana developed the visual foundation for her project by searching online for key words in both Spanish and English and discussing her findings in Spanish with her classmate, Esteban. Yuliana then layered words and sounds on top of her visual foundation to convey her mother's story and the civil unrest surrounding El Salvador when she fled. Images were not just a tool used to communicate her message, but also a resource that supported her in creating other messages throughout her project and planning her digital composition.

Becca's multimodal codemeshing process was more textually-driven than her classmates' processes (see Fig. 3). When constructing different parts of her project, she composed texts on the majority of her slides before incorporating other visuals, sound, or movement. Becca developed an outline for the content she wanted to include on each of her blank slides by writing a title or short description on each as a "placeholder." This organization helped her know "what [she] had to do and what was next," including finding songs and taking pictures of family photos with her cell phone at home between in-class workshops.

Kasim's modal path was a hybrid of Yuliana's visually-driven process and Becca's textually-driven process. He created slides by first writing a few words. Then, he devoted extended time to searching for and editing striking images to convey his message before



Fig. 4. The collage Yuliana created for the introductory slide of her “My Hero” project centered on her mother’s experience fleeing from El Salvador.

returning to and completing the textual components of each slide (see Fig. 5). Kasim explained that his main goal was to make his project “creative” and “pop out” through his “designs.” To do this, he emphasized the visual aspect of his project by “mostly focus [ing] on the backgrounds” of his slides. While he wrote in Bahdini in only two instances, he described that his “designs” with font choice and imagery included subtle references to his experiences in Iraq and his Kurdish pride.

The multimodal codemeshing process opened up opportunities for students to follow unique modal paths to tell their hero’s story. As evident in the timescapes, Kasim, Becca, and Yuliana relied on visuals and writing in different ways to scaffold their process and express their message.

4.2. Heritage language use in multimodal codemeshing process

A major feature across all students’ multimodal codemeshing processes was the use of heritage languages in oral and written forms across digital and face-to-face compositional spaces (see Table 3).

Two major themes emerged that describe how languages other than English were used in the composition process. First, student heritage languages were used strategically to support them in negotiating various demands of the composition process, such as accessing new information or composing messages for multiple audiences. Second, students used these languages strategically within the classroom ecology – or web of interrelated activities, goals, tools, and ideologies – in which this composing was situated.

4.2.1. Shaping local composing practices

We describe students’ use of heritage languages as practice. While this language use supported students’ participation in the composing process, language use was shaped by a convergence of the individual’s goals, the compositional tool, and the classroom context (Fraiberg, 2010). Below, we describe three related “bundles of activity” (Canagarajah, 2013), or practices, that were common across composers and attend to the convergence of these different features.

Two practices observed across students composing processes was the use of heritage languages to support their accessing of information online through both keyword searches and reading information in languages other than English. Yuliana, for example, searched for information on the Civil War in El Salvador by first using English key words, and then by searching for “cuando empezo la guerra civil en el salvador.” Becca conducted her searches for information in English but chose to translate website information by adjusting her web browser view to “Tieng Viet.” Consistent with Velasco and Garcia’s (2014) findings; students leveraged their heritage languages as resources alongside English to gather information to include in their digital compositions. This use of online searching was also strategic; however, in that students used these languages despite the dominant discourses concerning English in this classroom; and perhaps larger societal discourses concerning multilingualism. Although Ms. Lancaster did not speak these heritage languages and had not previously incorporated them into her instruction; the compositional tool afforded opportunities for students to engage with web-based multilingual communities in informational searches when composing.

A third practice observed across all three students was their use of translation to support different aspects of the composing process. Kasim reported not knowing how to transliterate his speech into Bahdini text and turned to Google Translate for assistance. Alternatively, Yuliana, though able to write in Spanish, was hesitant to record her voice in Spanish, as she had never done so before in

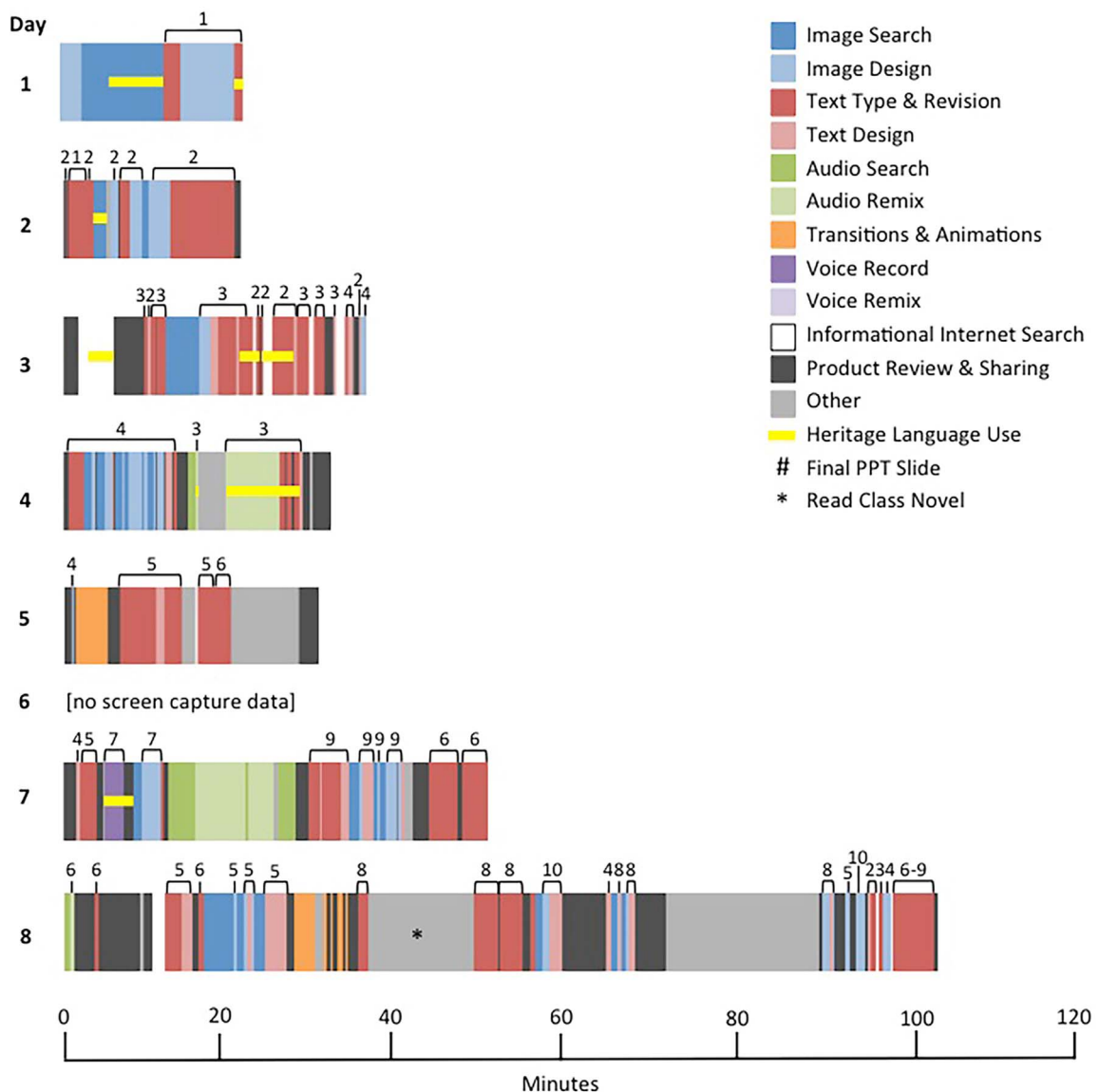


Fig. 5. Multimodal codemeshing timescape for Kasim's "My Hero" project.

Table 3

Students' use of heritage languages during the multimodal codemeshing process.

Use of heritage language while composing	Yuliana (Spanish)	Becca (Vietnamese)	Kasim (Bahdini)
Writing in "My Hero" project	•	•	•
Recording voice for project	•	•	•
Conducting interview	•	•	•
Using Internet keywords	•	•	•
Sharing work with peers	•	•	•
Listening & editing interview audio	•	•	•
Reading online	•	•	
Speaking to peers	•		
Translating interview notes by hand	•		
Chatting online with peers	•		
Using online translator			•
Including music in heritage language	•		

the classroom. She wrote out what she wanted to say first and orally practiced numerous times before feeling comfortable enough to record. These findings suggest that multimodal codemeshing practices, with their diversity and range, present new challenges and affordances for students. As students consider addressing multiple audiences, practices like translation and multilingual information searches can support student composing, and likewise, can be practices that can be honed through use and instruction. While Cummins (2005) has long argued for the purposeful integration of multiple languages in instruction, scholarship has recently begun to detail different approaches for strengthening students' translanguaging practices. Martinez's (2010) research with "Spanglish," for example, shows how raising students' awareness of their code-switching can support their writing of persuasive essays as they develop understanding of audiences. Similarly, Jiménez et al. (2015) has detailed how encouraging students' use of strategic translation in literacy activities can support not only their meaning-making in texts, but their understanding and awareness of translation as a meaning-making practice.

These findings also indicate the importance of considering certain language ideologies and historical uses of language within classroom spaces (Razfar & Rumenapp, 2012). While Yuliana described being ambivalent about using her Spanish in the classroom, Kasim was eager to share his Bahdini with classmates. Becca, on the other hand, expressed embarrassment about how Vietnamese sounds and demonstrated a hesitancy to use this language orally during composing. While, heritage languages supported each student's composing processes, the use of these languages during composing was shaped in part by students' relationship to these heritage languages.

4.2.2. Shaping local composing spaces

Wei (2011) has noted how students' translanguaging can shape local language spaces despite translanguaging not being traditionally welcomed within these spaces. Consistent with this work and similar observations of translanguaging in contexts that have not historically encouraged multilingual interactions (Gort, 2015; see also Daniel & Pacheco, 2016), we learned that the multimodal "My Hero" project was the first time students were invited to integrate languages other than English into their academic work. As such, students spoke of and showed trepidation when engaging in the practices of sharing work for feedback and recording heritage languages orally. Kasim verbalized "I'm scared!" multiple times throughout the unit when he recorded his voice speaking Bahdini, and explained that he was "shy in the beginning" because he had never recorded his voice speaking Bahdini and thought it sounded "weird."

Similarly, Becca asked Ms. Lancaster if she could go to the "recording room" – a storage closet adjacent to the classroom – when recording in Vietnamese. She explained, "I had to practice because I kept getting nervous. I kept stuttering. I had to keep saying it over and over again, which made me even more nervous." She was also embarrassed for others to hear her mom's "funny" accent in the interview excerpts, see pictures of her "short" extended family members, or read her mother's first name on her introductory slide because the Vietnamese spelling ("Bich") was similar to an expletive in English.

As demonstrated in all three students' multimodal timescapes, students still chose to use their heritage languages when sharing their multilingual work with one other. Furthermore, their retrospective interviews indicated feelings of pride in their bilingualism and family stories. Over the course of the project, Yuliana used Spanish more frequently in her composing. The majority of her writing and voice recording in Spanish occurred during the last two in-class workshops (see Fig. 1). She explained she was excited that her mother and classmates would understand sections written and spoken in Spanish, and in retrospect she wished she would have "written more things" using Spanish. Similarly, Kasim explained that he "really enjoyed" the project and his experience with multimodal codemeshing for the first time:

I never use my language in school. I mean, sometimes when I was a kid we like cheat on a test, like yell out some random words. But [now] we are using it for work, I was pretty excited for that...This is a thousand times better [than writing essays]. Just writing, there's like no fun of it, you're not going to remember it. I'm going to remember this, I feel like a lot of dedication went into this...I would like that if you showed it to other people.

Whereas Becca first began her process by covertly using Vietnamese and switching her search engine to "Tieng Viet," she concluded her composing by recording her voice out loud in Vietnamese and sharing it with Kasim. She told us she "kinda wanted [her] mom to hear it as well because she can't read English." She and her classmates had opportunities to use their languages in multiple parts of their projects; as they spoke and heard multiple languages in the composing process and as they considered how these languages were encouraged in the official space of the classroom, they increasingly incorporated these powerful tools into their digital compositions. At the same time, certain features of the compositional tool provided opportunities for students to explore these relationships and challenge some of the linguistic norms within the classroom. Students had opportunities to use these languages in oral and in written modalities, as well as in more private or covert uses such as searching for and accessing information online. These varied uses of heritage languages within the composing process supported students in not only creating multilingual and multimodal texts, but in creating a multilingual classroom space.

5. Discussion and implications

Through comparative analysis, we sought to understand multilingual students' multimodal codemeshing processes. In particular, we examined how three eighth-graders composed across multiple modalities and languages when using digital tools to create their "My Hero" project in an English Language Arts classroom. As one of the first studies to closely examine multimodal codemeshing processes, these findings shed new light upon the complexity and uniqueness of students' compositional journeys, which has important implications for understanding and supporting students' digital literacies.

5.1. What are eighth grade bilingual students' multimodal codemeshing processes?

Findings revealed that students initiated their process in similar ways – by exploring, sharing, and visually brainstorming. Their preference for experimenting with the tool and affordances of different modes and languages connects to Ito et al.'s (2010) work in out-of-school settings that illustrates how youth tend to “mess around” with digital practices before transitioning to fuller participation. Similarly, research on multimodal composition emphasizes the collaborative nature of digital projects, which opens up rich interactive space for students to share their design expertise and provide feedback (Black, 2009; Gilje, 2010).

Overall, students' gradual launch into the multimodal codemeshing process served a means to become acquainted with the tools, experiment with modal affordances (Jewitt, 2009; Kress, 2010), learn from others, and begin to conceptualize their projects. It is important to note that Ms. Lancaster did not excessively control the multimodal codemeshing process for students; she provided them with goals of the assignment, several differing examples, and explicit technical instruction. Instead of requiring students to write sections or storyboard first, they were able to dive head first into multimodal composing. Along with Dalton (2012), we believe there is value in providing students with compositional freedom to pursue their own multimodal codemeshing paths. Of course, explicit just-in-time technical assistance is imperative for integrating digital projects in the classroom; however, an important area for future work is understanding how to strike the perfect scaffolding balance so that educators do not stifle the creative process for students or overly rely on traditional writing supports for new and different types of digital composing.

Adolescents' multimodal codemeshing processes were complex and iterative (see also Bruce, 2009; Dalton & Smith, 2012; Smith, 2016), as they skillfully traversed text, visuals, sound, and movement during class workshops. Although writing processes have also been described as iterative (Flowers & Hayes, 1981), this study provides new understandings of how recursion occurred on multiple inter-related levels simultaneously – across modes, across phases of the process, and across sections of their multimodal projects. This contributes to our theoretical understanding of multimodal composition by underscoring the complexity, as well as material, cognitive, and communicative uniqueness of the process. Findings from this comparative study also extend what we know by also examining students' multimodal processes across different languages as they worked with digital tools. While each student orchestrated various modes to create their projects, they also simultaneously toggled back and forth between languages while composing, including recording their voice, writing, reading, and conducting online searches in their heritage languages.

The development of multimodal codemeshing timescapes as an analytic tool and visual display for this study not only provided a methodological contribution, but they also illustrated how students' modal traversals increased over time. Along with becoming more comfortable with using the digital tools and different modalities, students were continually seeing how all of the separate semiotic systems generatively and synergistically combined to create their multidimensional messages. By iteratively moving back and forth between images, words, and sounds, students were able to understand how modes worked together to create meaning. Multimodal codemeshing was a cognitively demanding task for students that required “more thinking” than just writing. Future research is needed that seeks to understand how multimodal codemeshing can serve as a tool for understanding content. In particular, research examining multimodal composing-to-learn and how student understanding deepens, travels, and transforms across modalities.

Even though students exhibited similarities in how they initiated their process, traversed modes, and integrated their heritage languages, the flexibility offered through multimodal composing also allowed students to individualize their processes. All three students visually brainstormed on the first day; however, there were central differences in how they leveraged visuals and writing when constructing their project. These modal differences in each student's processes hold important implications. Some research emphasizes the importance of using visuals as an entry point for student expression (Wessel & Herrera, 2014). Although students visually brainstormed in the beginning and Yuliana exhibited a proclivity for initially constructing her project with images, Kasim and Becca preferred writing first at varying degrees before layering images. More research is needed that examines the individualized and nuanced ways students work with different modes, including if they exhibit modal preferences (Kress, 2010; Smith, 2016) across projects or if their processes change based on different composing tools. As previously mentioned, these findings also underscore the importance of providing students freedom in their processes so they can follow any modal preferences for constructing meaning.

5.2. How do students use heritage languages during the multimodal codemeshing process?

Findings indicate that students used their heritage languages for different purposes in the composing process, including searching for and accessing information, translating to clarify content, interacting with peers to develop technical and linguistic expertise, and engaging with potential readers to develop aspects of voice. We also found that students' diverse use of heritage languages shaped language practices within the classroom, and as such, shaped the classroom space.

Students' multimodal codemeshing practices emerged within the classroom as the affordances of the tool, language ideologies, and the composer's goals converged within the composing process. Students became more fluent with the digital tool and the affordances of various modes, and similarly, demonstrated greater comfort in using and sharing their heritage languages over the course of the project. The digital nature of this project provided opportunities for students to draw from linguistic resources despite traditional monolingual ideologies within the classroom space – while students were embarrassed to speak out loud, they used their heritage languages on screen to support their composition. Furthermore, as students moved through the composition process and considered possible audiences both in and outside the classroom space, they meshed languages within their compositions to support their rhetorical goals.

A strong theme in research on multimodal composition is that projects open up space for students to express their linguistic identities in new and empowering ways (Black, 2009). Students' propensities to select from and manipulate multiple semiotic resources in their composing reflect theories of translanguaging (Garcia, 2009), where individuals draw on a holistic language system

to negotiate meaning with an interlocutor. We emphasize, however, that this use of resources was not autonomous or independent of context. Not only did the digital nature of this project encourage the use of multiple languages and modalities, but these traversals increased over time as students became more familiar with the composing tool. This study contributes to a growing body of translanguaging literature that examines this relationship between context and translanguaging, suggesting that students and teachers can challenge monolingual language ideologies through specific pedagogies and powerful classroom tools (de Oliveira, Gilmetdinova, & Pelaez-Morales, 2016; Jiménez et al., 2015; Rowe & Miller, 2016).

A limitation of these findings is the challenge of understanding students' language and modal use in light of their goals as composers, classroom members, and users of language, amongst other social identities (Norton, 2013). Certain aspects of language and students' linguistic identities were important but left unexplored in this analysis – including students' awareness of translanguaging practices like translation and codemeshing, the affordances of orthographical similarities between languages, and students' proficiencies in and experiences with writing in their heritage languages. Retrospective design interviews (Dalton et al., 2015), however, could be used in future work to uncover students' relationships to their language use. In our study, this method revealed that students' use of heritage languages was both goal-driven and strategic. For Kasim, using Kurdish in his composing process allowed him to access new information online without feeling embarrassed about speaking it directly in front of his classmates. For Becca, using Vietnamese in her composing process allowed her to engage not only her English-speaking classmates, but also her Vietnamese-speaking mother. More research should continue to explore how the affordances of digital tools create not only multiple entry points into composition for students (Wessels & Herrera, 2014), but create opportunities to engage a varied readership. We argue that such tools can create multiple “exit points” that connect the composer with readers across time and space, thus challenging the borders between the classroom and the community, and simultaneously, the socially constructed borders between students' languages (Pennycook, 2010).

6. Conclusion

With the growing prevalence of technology in students' lives and the need for proficiency in digital literacies for successful participation in an increasingly globalized and interconnected world (Leu, Kinzer, Coiro, Castek, & Henry, 2013) classroom instruction must take on the important role of developing multimodal literacies. Van Leeuwen (2015) posits that despite the seeming ease with which students access and use digital technologies, schools must find ways of offering students “something that is not readily available elsewhere” (p. 584). We agree, and argue that focusing on students' multimodal codemeshing processes positions educators to recognize the different practices that students bring with them to the classroom and offer them “something meaningful” (p.584) – an opportunity to hone these practices through instruction and use, as well as an authentic platform to share their work.

Furthermore, while today's classrooms become more multilingual and culturally diverse (Lucas & Villegas, 2011), scholarship has long pointed out subtractive schooling policies (Valenzuela, 1999) and the few opportunities that students have in classrooms for continuing to develop their heritage languages, especially in middle and secondary school settings (Daniel & Pacheco, 2016). Reyes (2012) argues that a constellation of literacy practices that reaches across schools and communities is needed in order to continue developing students' bilingualism and biliteracy. We suggest that multimodal codemeshing addresses one part of this constellation by encouraging students to consider how multiple linguistic resources and modalities can be integrated into the classroom in effective and meaningful ways.

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