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Translanguaging practices at a bilingual university: a case study of a science classroom

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The objective of this ethnographic case study is to describe in detail one professor’s translanguaging practices in an undergraduate science course at an officially bilingual university. The data-set is comprised of ethnographic field notes of 11 observed classes, audio recordings of those classes, an interview with the professor, and artifacts including the professor’s presentations, academic readings assigned, quizzes, and exams. Translanguaging practices—moments when both Spanish and English were used in presentation of academic content—are identified, analyzed, and presented in detail. Results show that translanguaging was strategic, dynamic, and woven through the presentation of academic content. In addition, translanguaging served to apprentice the Spanish-dominant students into English for scientific purposes. The translanguaging practices documented here illustrate the possibilities for other multilingual university classrooms around the world.

Keywords: translanguaging; bilingual education; higher education

Introduction

Within the international academic community, English is the taken-for-granted language of science (Tonkin 2011; Carli and Ammon 2007). This has ramifications for how science is taught in global contexts where English is not the principle medium of classroom communication. As the English language dominates the global exchange of scientific information (Tonkin 2011; Phillipson 2009), students in universities are studying academic content using English as an additional language (van der Walt 2013; Haberland, Lønsmann, and Preisler 2013; Feng 2007; Harder 2009; Mansoor 2004). At one such institution, the University of Puerto Rico at Mayagüez (UPRM), there is a constant pull between Spanish as the medium of instruction (grounded in the fact that Spanish is the language of everyday life in Puerto Rico) and English as ‘the language of science,’ with all of the promises for economic gain and social mobility that this implies (Phillipson 2009). Though Puerto Rico is a US territory, the language of everyday communication is Spanish, and Spanish and English are co-official languages (Pousada 1999). The university itself is officially bilingual, but no policy exists on the language of instruction, materials, texts, or assessment. Therefore, a student might study Chemistry using a textbook in English, while all of the interactions around this text, including professor’s lectures, study group sessions, and assessment measures, occur in Spanish. The situation is further complicated by the range of English proficiencies of students, some of whom

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have studied English as a special subject in school for 12 years to varying degrees of success, while others have graduated from private English-medium high schools well-prepared for university-level academic work in English.

Within the context of Puerto Rico, English-medium instruction is highly contested. Soon after the US invasion of 1898, the colonial government established English-medium education policies with the explicit aim of Americanization (Algren de Gutiérrez 1987). Though these Americanization policies were not effective in replacing Spanish as the vernacular in Puerto Rico, the perceived threat to Spanish at the hands of English remains more than 100 years later. Vélez (2000) described this tension about bilingualism in Puerto Rico as such: ‘Puerto Ricans for the most part enthusiastically support the concept of individual bilingualism … But the concept of societal bilingualism is certainly much more controversial’ (75). Within the context of English as a global language, particularly in the highly valued field of science, this push/pull which is the characteristic of Puerto Rico’s relationship with English is played out.

Much is at stake in the control of academic science discourse as English is increasingly becoming the taken-for-granted (‘naturalized’) lingua franca of science (Carli and Ammon 2007). Thus, though the role of English in science as enacted in the use of an English textbook in a Spanish-medium class may seem acceptable to professors and students because of a belief that English is ‘the’ language of science, there is nothing inherently scientific about English that should favor it over the use of any other language. The prestigious role of English is socially constructed; this socially constructed role is reified by the university influenced by forces of global capitalism that benefit from English’s dominant role (Phillipson 2009). This social construction of English is amplified in the colonial context of Puerto Rico. At the same time, the dominance of English in science is eroded as scientific talk takes places bi- or multilingually. This tension—between English as the only language of science and the reality of multilingual people ‘doing’ science multilingually—creates a sociocultural context ripe for translanguaging.

This case study of one professor in one university classroom in Puerto Rico developed out of a desire to closely examine language use in Spanish-medium science classrooms where the textbook is in English, a common practice at UPRM. The results reported here look particularly at translanguaging as a pedagogical practice in the classroom. Lewis, Jones, and Baker (2012) call this classroom translanguaging. Translanguaging is the use of multiple ‘languages’ in discourse, which goes beyond what has been traditionally known in linguistics as ‘code-switching,’ ‘code-mixing,’ or ‘language alteration.’ We are specifically interested here in (1) what translanguaging practices occurred during the delivery of scientific material and (2) the pedagogy behind and around translanguaging.

Theoretical understandings of classroom translanguaging

Translanguaging is a term originating in the field of bilingual education that has become increasingly used by prominent scholars to describe the ‘multiple discursive practices in which bilinguals engage in order to make sense of their bilingual worlds’ (Garcia 2009, 45, emphasis in original) (For more on the history of translanguaging as a term, see Lewis, Jones, and Baker 2012). The move away from traditional linguistic terms such as code-switching, code-mixing, borrowing, etc. to describe this phenomenon marks a paradigm shift that calls into question the existence of ‘languages’ as identifiable, distinct systems. From this perspective, the notion of language as a set of pre-given features and discrete skills is an ‘invention’ (Makoni and Pennycook 2007). Rather, ‘language is an
ongoing process that only exists as languaging’ (García and Leiva 2013, 204, emphasis ours). This ongoing process of languaging both shapes and is shaped by people as they interact in specific social, cultural, and political contexts. The emphasis on process—the ‘-ing’—purposefully shifts the focus away from ‘code.’ Instead, the agent in the act of meaning-making is central. Translanguaging refers to the constant, active invention of new realities through social action. García and Leiva (2013, 207) state:

The concept of translanguaging goes beyond code-switching. Code-switching refers to the mixing or switching of two static language codes. Translanguaging, resting on the concept of transculturación, is about a new languaging reality, original and independent from any of the ‘parents’ or codes, a new way of being, acting and languaging in a different social, cultural and political context. Translanguaging brings into the open discursive exchanges among people in ways that recognize their values of languaging. In allowing fluid discourses to flow, translanguaging has the potential to give voice to new social realities.

For researchers, translanguaging opens the door for new understandings of bilingual classrooms and learning. Through the use of translanguaging in classrooms, professors can disrupt the accepted social order that positions English monolingualism as ‘the language of science.’ In this way, as Garcia and Leiva (2013) assert, translanguaging opens the door for the possibilities of acting for social justice.

Translanguaging takes bilingualism as the norm, which is in itself a socio-political action. From this perspective, what has traditionally been seen as a movement between two separate ‘codes’ (thus ‘code-switching’) ceases to look like shuttling between two systems. In contrast to flicking on and off a language switch, translanguaging creates a new way of languaging. These languaging practices are fluid—only from a monolingual perspective do they seem strange, confusing, or jarring. Bilinguals translanguate to construct and negotiate meaning. In sum, to refer to the communicative practices of bilinguals as translanguaging practices emphasizes the growing understanding that (1) languages are not two separate ‘wholes’ but rather a range of interconnected repertoires that bilinguals perform as they make meaning and (2) bilinguals deftly enact these repertoires as they learn (whether blatantly or surreptitiously).

Here we attempt to describe classroom translanguaging practices as they were integrated in talk, written text, and diagrams—in other words, as dynamic practices that crisscrossed through the modes of classroom communication. We recorded spoken translanguaging practices that were clearly and inextricably linked to other classroom translanguaging practices such as codemeshing and switching the languaging mode in the classroom (i.e., reading a text in English and talking about it in Spanish). We use codemeshing in Canagarajah’s (2011a) sense of the term as ‘the realization of translanguating in texts’ which ‘accommodates the possibility of mixing communicative modes and diverse symbol systems (other than language)’ such as diagrams or other graphics (403). Translanguaging does not happen in a vacuum, nor out of context. As a practice it is linked to other discursive practices at work in bilingual classrooms.

Garcia and Sylvan argue that

translanguaging includes code-switching—defined as the shift between two languages in context—and it also includes translation, but it differs from both of these simple practices in that it refers to the process in which bilingual students [and we would add, teachers] make sense and perform bilingually in the myriad ways of the classroom—reading, writing, taking notes, discussing, signing, and so on. (2011, 389)
Though translanguaging and code-switching are not inter-changeable terms, we begin by reviewing the literature on classroom code-switching in order to build our case for understanding classroom translanguaging.

In traditional notions of bilingual education, code-switching has been seen unfavorably (Baker 2006; Garcia 2009), since from a monolingual perspective switches are thought to be ‘crutches’ used when bilinguals do not know how to express something in one of their languages (Martínez 2010). However, there is a growing body of research that accepts it as part of the meaning-making process of bilinguals and attempts to categorize the pedagogical (and other) functions of code-switching in content classrooms (c.f. Merritt et al. 1992; Camilleri 1996; Palmer 2009; Reyes 2004; Setati et al. 2002; Fennema-Bloom [2009] 2010).

In his 2003 review of research on classroom code-switching in post-colonial contexts, Ferguson articulates three broad categories of the pedagogical function of code-switching (CS):

1. CS for curriculum access. Basically, to help pupils understand the subject matter of their lessons.
2. CS for classroom management discourse, e.g. to motivate, discipline and praise pupils, and to signal a change of footing.
3. CS for interpersonal relations, e.g. to humanise the affective climate of the classroom and to negotiate different identities. (2003, 39)

Though Ferguson does review some limitations of the current research, he asserts that overall the literature finds code-switching in the classroom ‘one potential resource for mitigating the difficulties experienced by pupils studying content subjects through a foreign language medium,’ and that the literature is ‘consistent on its [code-switching’s] utility as a communicative resource’ (49).

Fennema-Bloom ([2009] 2010) further elaborates on the pedagogical functions of code-switching from a Vygotskian perspective, calling it ‘code-scaffolding,’ which emphasizes how this classroom practice serves to teach content. Her study of Mandarin Chinese and English bilingual content teachers identified five types of pedagogic functions of code-scaffolding: (1) instructional for content acquisition, (2) reformulation, (3) instructional for language acquisition, (4) facilitation, and (5) habitual. She concludes, ‘in code-scaffolding, language is used as a strategic tool in the development and comprehension of the instructional content’ (34).

Creese and Blackledge (2010) find similar teaching and learning strategies underlying pedagogic translanguaging in a complementary school for Gujarati and English speakers. However, their analysis incorporates a consideration of how students and teachers perform identities through language. Taking an ecology of languages perspective, they find that it is often the combination of languages that drives tasks. Both teachers’ and students’ language practices were heteroglossic (in the Bakhtinian sense, that is, multivoiced by nature of being embedded in a context that is defined by the place, time, and social and historical conditions in which it is uttered), and all participants were keenly aware of the identities at work in languaging performance in the classroom. They conclude:

This pedagogy adopts a translanguaging approach and is used by participants for identity performance as well as the business of language learning and teaching … we think the bilingual teachers and students in this study used whatever signs and forms they had at their
disposal to connect with one another, indexing disparate allegiances and knowledges and creating new ones. (112)

Canagarajah (2011a) further investigates multilinguals’ use of ‘whatever signs and forms’ are available to them and the deep connections this use has to identity enactment in texts. In one of the few studies of translanguaging in texts, and one of even fewer looking at higher education, he explores how one graduate student used codemeshing to make meaning using Arabic, English, French, and symbols in her academic writing. His emphasis on the process of the graduate student exploring the ways in which she can use all of her communicative repertoire as an integrated system shows how translanguaging in texts is strategic and at the same time raises important questions about how to assess translanguaging competence in academic settings.

In sum, the literature shows that bilingual interactions in classrooms are a normal and many times inevitable (Palmer 2009) part of bilingual learning. In Canagarajah’s synthesis of research on translanguaging, he notes that ‘what current classroom studies show is that translanguaging is a naturally occurring phenomenon for multilingual students’ (2011b, 8). That is, in bi- and multilingual environments, students (and often teachers) use their entire linguistic repertoire strategically to teach and learn, and that as they do this there is a keen awareness of the identity consequences of linguistic performance. However, much remains in question about translanguaging in classrooms. Almost no literature exists on translanguaging in higher education, particularly in contexts where there is no set policy as to the language of classroom instruction (as in our case). In addition, few studies look at content classrooms where translanguaging happens spontaneously, and with the goal of content acquisition. Questions remain about how exactly translanguaging is used to enhance content acquisition, particularly in science education, and this study hopes to shed light on such questions.

To return to the theoretical notion of translanguaging and its grounding in a post-structural linguistics, we use the term translanguaging to include practices that indicate the movement among linguistic repertoires that would not, from a monolingual perspective, look like a ‘switch.’ For example, when the professor in this study points at the phrase ‘more preferred’ written on a diagram and says in Spanish ‘más preferida,’ this is translanguaging. It assumes students understand cognates and make the connection between the written English they see and the spoken Spanish they hear. When he pronounces the acronym E.P.A. as /epa/ in Spanish while the slide behind him defines the duties of the agency in English, this is also translanguaging. The Spanish pronunciation of the acronym references the English definition being provided, and both students and professor understand this symbiotic meaning. Thus, as García and Sylvan write, translanguaging is a set of practices made up of the ‘myriad ways’ in which teachers and students ‘perform bilingually.’ Translanguaging is bilingual performance because it relies on the use of both Spanish and English simultaneously all the time. Our examples will illustrate how and why this is so.

Methodology
In order to understand (1) what translanguaging practices occurred (as defined in the previous section) during the delivery of scientific material and (2) the pedagogy behind and around this translanguaging, we did a case study of one professor in one science classroom at our university. Though the case study methodology does not claim to make generalizations to entire populations, this case was chosen because the course’s use of written materials in English (academic articles, PowerPoints) with in-class verbal
interactions (lectures, discussions) in Spanish and assessment in Spanish was understood to be a common occurrence in science classes at our university. Thus, though we report here a specific case, it is the first step in describing a common practice in our context.

Setting

The UPRM is the premier science and engineering campus of the UPR system. The university’s official documents say little about language policy. The undergraduate academic catalogue states that UPRM is a ‘co-educational, bilingual, and non-sectarian school,’ and that ‘Spanish is the language of instruction in most courses, but students are required to have a working knowledge of the English language as well. The professor decides the language used in his or her lectures and student evaluation activities’ (emphasis ours). A large-scale needs analysis showed that in most science classes texts were read in English, while talk-around-texts and assessments took place in Spanish (Mazak and Herbas-Donoso 2014). This prompted our desire to look closely at the linguistic and pedagogical consequences of this type of bilingual science classroom.

Participants

The particular course observed was an upper-level undergraduate plant science course. It was chosen because of our familiarity with one of the students taking the class. Victor, the focal professor, was a Puerto Rican male assistant professor. His BS and MS were from the UPRM in the department in which he teaches. His PhD was from a large state university in the USA. In our previous study, we found that almost all science professors held doctoral degrees from US institutions (Mazak and Herbas-Donoso 2014). In that way, Victor was quite typical. He was somewhat unique, however, in that he had been a student at our institution and thus uniquely understood the needs and students in his course (as he had taken the same course in the same classroom as an undergraduate).

Data collected

Data were collected by the research team, which consisted of the two authors of this paper. We visited the course 11 times, or almost once per week in the 15-week semester, to observe the class with a focus on language use. The first two observations were conducted by both members of the team, and subsequent observations were conducted by author 2. Ethnographic field notes of 11 observations between September and December 2011 (50 minutes each) became the record of our data, along with audio recordings of 7 of those observations, which we used to double-check our field notes. The focus of our note-taking was language use, and we were originally guided by a focus on ‘code-switching,’ which quickly expanded into our broader focus on ‘translanguaging.’ In this sense, our own process of data collection and analysis reflects the development of narrow understandings of ‘code-switching’ to the more broad concept of ‘translanguaging’ reflected in the above literature review. The focus on code-switching was abandoned as we realized that the bilingual nature of interactions in this classroom was much more complicated than the traditional notion of ‘code-switching’ could capture. For example, we observed the professor speaking Spanish cognates of English terms while gesturing toward the written English text on a PowerPoint slide. This behavior is not a ‘code-switch,’ yet there is clearly a bilingual proficiency being evoked in that moment that is more appropriately captured through the notion of translanguaging.
We focused on translanguaging that involved speaking, i.e. we did not record every instance of translanguaging written in the PowerPoint slides, but only those events that had a spoken component, as our goal was to observe translanguaging in the context of classroom teaching. We called these ‘translanguaging events.’ In sum, our field notes recorded all observed instances of translanguaging that happened during class (exactly what was said, what was being projected at the moment the translanguaging occurred, etc.). Artifacts from the course were also collected, including Victor’s PowerPoints, academic articles assigned as readings, two quizzes, and three exams. In addition, we conducted one 45-minute interview with Victor about his language use in the class in order to double-check our analysis of his motivations for translanguaging.

Data analysis

Our data analysis sought to describe and understand translanguaging practices within their pedagogical context. Again, our method of analysis shifted as we began to analyze our data. Initially, we coded events for the pedagogy around the translanguaging, asking ourselves what was the pedagogical purpose of the translanguaging using Fennema-Bloom’s five categories. However, it was soon evident that almost all translanguaging events in our case study occurred for the purpose of content acquisition. These categories, therefore, were not helpful in truly describing translanguaging in our context, likely because Fennema-Bloom’s categories did not fully engage with the theory of translanguaging. Indeed, it became apparent through these false starts at coding that we were describing translanguaging as a particular phenomenon in our context, and categories imposed from the outside did not adequately fit the data nor align with the theoretical frame. For this reason, we put aside Fennema-Bloom’s categories (and all other categories from the literature reviewed above) in favor of describing the particularities of translanguaging in this case study using categories that came up from our open coding of the data, driven by our desire to understand the pedagogy behind and around translanguaging.

In order to code our data in a way that both captured the nuances of translanguaging in our context and aligned with our theoretical frame, we divided our field notes into ‘translanguaging events,’ or contextualized moments where translanguaging occurred. We included in these events field note excerpts and their corresponding artifacts, such as PowerPoint slides, readings, and quizzes, in order to fully understand the context of the verbal translanguaging (i.e., what text or diagram was projected in front of the class when the translanguaging occurred). We coded the data as a research team, negotiating between us how we would describe and categorize each event in codes. Our coding began with looking closely at translanguating events and attempting to identify different types of translanguaging practices that Victor used in his class. We identified the following translanguaging practices:

1. using English key terminology in discussion of scientific content in Spanish
2. reading text in English and talking about it in Spanish
3. using Spanish cognates while referring to English text
4. talking about figures labeled in English using Spanish
5. pronouncing English acronyms in Spanish

Representative events for each practice are included in the ‘Results’ section.

After grouping the events into these different practices, we took a conceptual step back and asked ourselves how translanguaging was functioning pedagogically in the classroom. This led us to re-code and re-group the events once more, asking of each
event: Why does translanguaging occur at this moment? What meaning-making resources are being engaged during translanguaging? What greater pedagogical purpose does translanguaging serve? Through this analysis, the complexity and deeply bilingual, multimodal nature of the observed classroom practices were revealed. There are three main analytic points that surfaced during this stage of analysis:

1. The use of texts entirely in English and codemeshed texts prompted verbal translanguaging in the classroom.

2. Translanguaging activated all students’ meaning-making resources: Spanish, English, and graphic interpretation. In doing so, it did not always look like a traditional ‘switch,’ but rather clearly relied on student’s bilingual and multimodal resources to make meaning. This is very well exemplified by reading a scientific article in English and explaining it in Spanish.

3. Translanguaging apprenticed students into the larger scientific discourse community. This, we will later argue, is particularly important in the socio-cultural context of Puerto Rico.

Results

If one were to look at our data through the lens of code-switching in its traditional sense, the results would not be very interesting. All ‘switches’ occurred with the majority of the discourse in Spanish and the use of English nouns or noun phrases, and all occurred for the purpose of learning academic content. To look at the data this way misses the complexity of what occurred in the study. Indeed, ‘switching’ noun phrases would quickly be dismissed as not ‘switches’ at all but rather ‘borrows,’ and for that reason not very important or interesting. By looking at the data grounded in a theory of translanguaging, however, the complexity and deeply bilingual, multi-modal nature of the observed classroom practices are revealed. The following sections are organized by the three analytical points previously outlined. Selected events represent the translanguaging practices identified during coding.

English texts prompted translanguaging

Victor’s class relied heavily on PowerPoint presentations, which he made available to students using the online course system Moodle. He delivered his class following these presentations, which always included diagrams and photos to illustrate his main points. Often these graphics were pulled from English texts. When slides contained English (either in combination with Spanish or English alone), Victor often translanguaged while explaining them. In this way, English text prompted translanguaging. The more English text was on the slide, the more translanguaging occurred in Victor’s delivery of the material. The excerpts in Example 1 are taken from a class where the PowerPoint delivered had originally been prepared for an academic conference in the USA, and thus was entirely in English:

Example 1

V: ‘¿Qué es el site-specific weed management? Bajar los residuos de los herbicidas’ / What is site-specific weed management? To lower herbicides residues
V: ‘Vamos a hacer **field scouting data**. ir al campo, tomar los datos, lo que se dice en inglés **survey**. We’re going to do field scouting data, we go to the field, we collect the data, it is what we called in English survey

V: ‘**Ground-based Detection Systems**, es utilizar el reflejo de la luz, no por satélites, ni nada de eso. Tenemos el **Weed Seeker** que es un buscador de malezas’. Ground-based Detection Systems, using reflected light, not by satellite, or anything like that. We have the Weed Seeker, its job is to search for weeds. (field notes, November 2011)

Here Víctor used the translanguaging practice of using English key terminology in the discussion of scientific content in Spanish. The professor inserted the words: ‘site-specific weed management’ inside a Spanish question and then he explained this string of scientific terminology in Spanish. In the other two excerpts, the professor pointed to the titles: ‘How is it done?’ and ‘Ground-based Detection Systems’ and then he explained the terms in Spanish. He also did a direct translation from English to Spanish of the term ‘Weed Seeker’ to ‘buscador de malezas.’

When the professor started his lecture, he clearly expressed that the entire PowerPoint presentation was in English. He acknowledged that students might have to put extra effort into following it (‘quiero que le presten mucha atención’/I want you to put a lot of attention), and he facilitated the classroom’s ambiance by turning off the lights in order for students to better see the slides (‘el background es negro, y necesito que vean bien’/the background is black, and I need you to be able to see well). While keeping technical and scientific key terms in English, he also ensured that the concepts were explained and understood by students using Spanish. This weaving of English and Spanish occurred in relation to the projected English text. Víctor purposefully kept scientific terms in English but he made sure that students understood them by providing an explanation in Spanish. By using this translanguaging practice, he built students’ content knowledge and facilitated their access to the scientific community. There is probably no better way for bilingual students to deeply understand new content than to use their language of strength (in this case, Spanish), as an instrument for discussing, analyzing, and reflecting on the concepts they are learning (García 2009).

**Translanguaging activated all meaning-making resources**

The inclusion of English text was often, but not always, linked to reading diagrams and other figures that Víctor extracted from texts and online sources in order to teach academic content. Labels on these figures were not translated; Víctor either assumed students could read the English or navigated them through it. Regardless, he used translanguaging to do so. In the process, students had to bring all of their multi-modal meaning-making resources to the table to interpret the diagram. That is, the act of diagram interpretation in Víctor’s class involved understanding Spanish, English, and visual representations of material, and how these symbol systems worked together to convey scientific meaning:

**Example 2**

Students and professor had the same article in front of them. Students’ attention was pointed to a bar graph in the article, where it says: ‘Least preferred.’

V: ‘esa es la ventaja de este tipo de estudio, que utilizan la más preferida y la menos preferida. En Estados Unidos, ésto se utiliza mucho, estos tipos de peces controlan malezas, es un control biológico’/this is the advantage of this type of study, they use the more...
preferred and the least preferred. In the United States, this is used a lot, this type of fish controls weeds, it is a biological control. (field notes, September 2011)

Once the professor brought students’ attention to the specific bar graph, he translated the term ‘least preferred’ to ‘la menos preferida y la más preferida,’ adding context by including ‘la más preferida.’ He then went on in Spanish to synthesize the key information from the graph, which was labeled in English. The reliance on cognates here illustrates another translanguaging practice. The professor did not have to explicitly translate the graph’s label ‘least preferred,’ instead relying on students’ bilingual ability to make the quick connection to the Spanish cognate ‘menos preferida.’ This translanguaging practice (using Spanish cognates when referring to English text) goes by without a blink from students or professor, as the fluidity and mutual understanding of Spanish/English cognates do not merit special attention in this bilingual classroom. The professor facilitates students’ comprehension of the graph labeled in English by talking about it in Spanish. Both students and professor bring their knowledge of Spanish, English, and symbols (the bar graph) to make meaning and thus teach/learn the scientific content under study. Translanguaging events such as this one provides students opportunities to develop metalinguistic abilities. They drew on their already established linguistic repertoire and made connections with the other language in order to facilitate content learning.

Example 3

The following event was taken from a PowerPoint presentation. The slide discussed consisted of an elaborate diagram about soil-herbicide interactions that was taken from a book written in English.

V: ‘en este diagrama, ¿lo entienden?, ¿ustedes han escuchado esta palabra leaching? Esto es percolación, algo que traspasa, pasa a través del nivel del suelo. Ustedes ven todo lo que puede ocurrir en ese perfil del suelo, bueno todo eso puede suceder con los herbicidas’/ in this diagram, do you understand it?, have you heard this word leaching? It is percolation, something that goes through, it pierces the soil level. Now you can see what could happen in this soil profile. Well, all this can occur with herbicides. (field notes, October 2011)

All text on the slide was in English. It consisted of a soil-herbicide diagram with key terms such as: topsoil, subsoil, photo decomposition, detoxification, crop removal, leaching, and capillary flow. The professor explained the slide in Spanish, but he said the word ‘leaching’ in English. He then translated and explained ‘leaching’ in relation to the rest of the diagram. He used two translanguaging practices in this example: using English key terminology in discussion of scientific content in Spanish and talking about figures labeled in English using Spanish.

Again, we see English text prompting translanguaging. Aware that students were processing written English, the complex diagram, and spoken Spanish simultaneously, the professor focused their attention on the key term ‘leaching’ by slowing down and checking for understanding: ‘en este diagrama, ¿lo entienden?, ¿ustedes han escuchado esta palabra leaching?/ in this diagram, do you understand it?, have you heard this word leaching? By emphasizing this term in both languages, translanguaging is used as a tool to enhance content understanding. In the interview, the professor said that one of his pedagogical strategies was to focus on the most important and meaningful information presented to students. To accomplish this, he not only said the term in English and then translated the term into Spanish, but he also explained the role of this term in the figure.
Because the professor can and does use translanguaging as a pedagogical tool, he has in his repertoire an additional way to teach students to understand and appropriate scientific key terms, an advantage over monolingual science professors. Understanding science often requires understanding a set of interconnected concepts that demands specific vocabulary in order to comprehend these interrelationships, and translanguaging helps the professor teach that.

**Example 4**

The following event was taken from a PowerPoint presentation. The slide that is the focus of analysis consisted of a diagram of electron flows with a legend of approximately 8 sentences in English at the bottom of it.

\[ V: \text{`el flujo natural de los electrones, y exactamente aquí tenemos dos proteínas, el transporte de electrones, stopping the flow of electrons. ¿Qué más ustedes ven? Este diagrama lo tienen en el libro, el libro está en la biblioteca.'} \]

\[ /: \text{the natural flow of electrons, and exactly here we have two proteins, the transport of electrons, stopping the flow of electrons. What else do you see here? You have this diagram in the book that it is in the library. (field notes, October 2011)} \]

The slide was completely in English with a complex diagram on it. The professor initiated the explanation in Spanish but later he introduced a phrase from the legend at the bottom of the diagram: ‘stopping the flow of electrons.’ Next, he asked students what else they saw, specifically directing them to where they can read more about it. As in the previous example, Víctor used two translanguaging practices: using English key terminology in discussion of scientific content in Spanish and talking about figures labeled in English using Spanish.

As mentioned before, it was a common practice to have slides, partly or completely, in English while the discussion was carried out in Spanish. These codemeshed texts prompted verbal translanguaging events. As the professor used Spanish to verbally talk students through the diagram, he translanguages, saying ‘stopping the flow of electrons’ in English. He does not translate or define this short phrase about content. A translation is unnecessary, as the short phrase occurs embedded in rich context. Students have oral Spanish context, written English context (on the slide), and the graphic context of the diagram with which to make content meaning during this event. It is all these contexts combined that allow for this translanguaging moment to occur.

**Translanguaging apprenticed students into scientific discourse community**

In Example 4 of the previous section, translanguaging is an explicit pedagogical strategy used in order to give students access to the larger scientific conversation. When the professor says, ‘Este diagrama lo tienen en el libro, el libro está en la biblioteca.’/You have this diagram in the book that it is in the library,' he uses Spanish to refer students to scientific resources in English. His careful Spanish explanations of content written in English apprenticed students into the use of this scientific content and modeled how translanguaging is part of scientific study in this community.

Translanguaging helped students appropriate scientific concepts and terminology (Fennema-Bloom [2009] 2010). Again, this gave them access to the larger scientific community, as they could do library and Internet searches which would yield more results in English than in Spanish. In Examples 5 and 6, students had the assignment to read a scientific article written in English about using fish to control aquatic weeds. The
professor translanguaged English key terms within Spanish talk-around-text during the classroom discussion:

**Example 5**

The professor gives each student a copy of the scientific journal article written in English, which they were supposed to have downloaded and read before class.

V: ‘**Stocking rates**, alguien sabe ¿qué es stocking rates?, pues es ésto lo que hicieron básicamente los autores … Para el examen es bien importante que ustedes sepan el crecimiento de estas plantas’/Stocking rates, does anyone knows what stocking rates are?, because this is what the authors basically did … It is very important for the exam to know how these plants grow. (field notes, September 2011)

After some discussion in Spanish the professor introduced a key technical term that he kept in English, ‘stocking rates,’ explaining in Spanish what the term meant in reference to the article. Then he explained the methodology used in the paper, that is synthesized with the key term ‘stocking rates.’ He mentioned that determining ‘stocking rates’ was exactly what the authors did and he emphasized the importance of knowing how the plants grow for the exam. This translanguaging practice involves fluid movement between English text and Spanish discussion and served as a de-briefing of the scientific content presented in English in the text. Here, translanguaging of the key term ‘stocking rates’ helped students deepen their understanding of the term while simultaneously giving them access to the larger scientific conversation (which is happening in English) about the content. This example shows common translanguaging practices in this flexible bilingual classroom where the reading was in English and the discussion around the reading was in Spanish with the incorporation and appropriation of technical and scientific terms.

**Example 6**

The following sample was taken from a PowerPoint presentation. The slide presented two acronyms with their respective meanings. The professor explained the function and the purpose of each entity.

![Figure 1. Pesticide regulations slide (written by professor).](image)
V: ‘En el caso de la FIFRA /fifra/ hay un proceso a seguir para aplicar este producto, se establece en general las reglas a seguir. En el caso de la EPA /epa/, fue en 1970 que se creó, esta organización se rige bajo la acta de la FIFRA /fifra/. Todos los productos tienen que estar registrados en la EPA /epa/. Se desarrollan protocolos, se estudia para qué producto conviene qué cosa/in the case of FIFRA there is a procedure to be followed in order to apply the product, in general there is an establishment of rules to comply. In the EPA’s case, it was in 1970 that it was founded, this organization is governed under FIFRA. All the products have to be registered in the EPA. Protocols are developed, studies are carried out to determine what the product is most useful for. (field notes, September 2011)

The translanguaging in this event is multi-layered. The slide of which the professor was explaining was itself a codemeshed text. Both acronyms were printed on the slide with their respective meanings: FIFRA, Federal Insecticide and Rodenticide Act, and EPA, Environmental Protection Agency. Following each acronym were 3–4 lines of explanation in Spanish of the role and the work each agency performs. When referring to the acronyms, the professor pronounced them in Spanish (/fifra/ and /epa/). This contrasts with the English pronunciation of the acronyms, /fIfra/ for FIFRA and the articulation of the letters ‘e’ ‘p’ ‘a’ for EPA. Thus, while the projected text is English, the talk is Spanish. Pronouncing English acronyms in Spanish was a common translanguaging practice identified in the data. Though the professor has written out the meaning of the acronyms in English, he does not directly translate their meaning into Spanish. Instead, he used Spanish to explain the purpose and function of each agency and how these agencies are interrelated.

Translanguaging is evident here as a pedagogical strategy, which the professor made explicit in a follow-up interview. In the interview, the professor explained the reason for leaving certain terms in English. He said:

trato de mantener mucho de los conceptos en el idioma inglés porque sino se pierde el significado del concepto como tal … sucede lo mismo con FIFRA … si yo lo traduzco sería el Acta Federal de Insecticida Fungicida y Raticida aunque la primera letra corresponde, el orden está inverso y si tú buscas eso en cualquier libro o en el internet como tal nunca lo vas a encontrar, porque no aparece así, aparece como FIFRA/ I tried to keep many of the concepts in English, otherwise the meaning of the concept as such is lost … the same thing happens with FIFRA … if I translate it, it will be Acta Federal de Insecticida Fungicida y Raticida, although there is a letter correspondence, the order is inverse, and if you look it up as such in any book or on the internet, you will never find it, because it doesn’t appear like that, it appears as FIFRA. (Interview, May 2012)

The professor had specific motivations and reasons for using both languages; there were pedagogical considerations involved in this continuous back and forth of English and Spanish. The strategy behind his translanguaging was to endorse a common terminology across languages in the scientific community.

Example 7

The professor explains a PowerPoint slide entitled: ‘Environmental Fate’ (written in quotation marks at the top of the slide). The rest of the slide is an explanation (approximately 5 sentences) of the meaning and the purpose of the concept in Spanish. Referring to the title of the slide (‘Environmental Fate’) the professor says:

V: ‘es lo que definimos en cómo y dónde entra en el medio, cuánto tiempo va a permanecer ahí. Este concepto [Environmental Fate] lo vamos a mantener así, en inglés. Si ustedes van a Google, lo encuentran así/it is what we define as how and where something goes in the
environment, how long it will stay there. We will keep this concept [Environmental Fate] like that, in English. If you go to Google, you will find it like that. (field notes, October 2011)

Example 7 came from a day when the professor used a PowerPoint presentation that he had developed for a conference presentation in English to deliver a class in Spanish to the students. Thus, all the slides were written in English, but his talk was mostly in Spanish. At the beginning of the class he told the students: ‘hoy la presentación toda está en inglés, quiero que le presten mucha atención … Es una presentación que di en Estados Unidos sobre un proyecto que estábamos haciendo’/today the whole presentation is in English, I want you to pay close attention … It is a presentation I did in the United States on a project we were doing. This extra emphasis on paying attention prepared the class to manage the large amount of translanguaging that was to occur that day.

The professor kept the key concept ‘Environmental Fate’ in English and put it in quotation marks to separate or highlight this concept from the rest of the text written in Spanish. When he started his explanation in Spanish, he pointed to the words, Environmental Fate on the slide. Although he did not actually say the words in English, in this translanguaging event the professor’s talk about the slide relied on students reading the phrase. Further, the professor emphasized his intention to keep the concept ‘Environmental Fate’ in English. He did not translate the concept but rather gave a succinct explanation in Spanish of what the concept means. Data from the interview with the professor revealed that some key terms are purposely kept in English in order to facilitate students’ access to the scientific community (see ‘stocking rates’ in Example 1; ‘FIFRA’ and ‘EPA’ in Example 6, Figure 1). Another reason stated by the professor to keep the concept in English was the accessibility of finding more information: ‘si ustedes van a Google, lo encuentran así’/if you go to Google, you will find it like that. The professor aimed to initiate students into the ability to find information beyond the classroom setting, to independently and actively search key terminology written in English.

**Conclusion: translanguaging, science, and the context of Puerto Rico**

This case study of one professor in a particular science course illustrates how translanguaging practices are carried out in a university science classroom in Puerto Rico. We were particularly interested in: (1) what translanguaging practices occurred during the delivery of scientific material and (2) the pedagogy behind and around translanguaging. To summarize, we found that most translanguaging occurred around English texts, and that mostly key terminology was being translanguaged. In addition, translanguaging required the activation of all students’ meaning-making resources, for example, when understanding diagrams labeled in English. Finally, translanguaging was a way used by the professor to apprentice students into the scientific community. In the process of illustrating our findings, we have shown that translanguaging is indeed a set of practices, which included: using English key terminology in discussion of scientific content in Spanish; reading text in English and talking about it in Spanish; using Spanish cognates while referring to English text; talking about figures labeled in English using Spanish; and pronouncing English acronyms in Spanish.

Victor successfully created what Li Wei (2011) refers to as a ‘translanguaging space,’ which Li argues is ‘transformative in nature.’ Li Wei states that translanguaging:

creates a social space for the multilingual language user by bringing together different dimensions of their personal history, experience and environment, their attitude, belief and
ideology, their cognitive and physical capacity into one coordinated and meaningful performance, and making it into a lived experience. (1223)

Through Víctor’s use of translanguaging, the science classroom becomes a space where Spanish is legitimized as a language of science, while the connection to scientific discourses in English is also valued and purposefully developed. Indeed, Víctor’s translanguaging practices develop students’ bilingual academic repertoires, breaking the monopoly of English as the only language of academia in science as a field. In this way, translanguaging helps to uncover the misconception of a monolingual world as the norm. In this back and forth of both languages, students develop a positive sense of self as bilingual individuals because they see their bilingualism as a resource.

We have argued earlier in this paper that the theoretical underpinnings of translanguaging call for a ‘normalizing’ of bilingualism which is itself a socio-political act. We further argue that the translanguaging practices Víctor used in this case study were particularly important and liberating in the colonial context of Puerto Rico. That is, rather than imposing or requiring English as the medium of instruction, Víctor strategically uses English as a way to teach students how to gain access to the global scientific community, while maintaining the classroom talk in Spanish in order to respect the Puerto Rican context and play with students’ strengths. In colonial contexts, the push–pull of the colonial language is evident. Imposing the colonial language (in this case, English) is just as harmful as withholding that language (Mazrui and Mazrui 1998). Víctor negotiates this push–pull through translanguaging. He does so strategically and to the benefit of his students.

Accepting the position of English as ‘the language of science’ has led to the adoption of English-medium science programs in other non-English-medium contexts (see the growing body of literature on internationalization in European universities, c.f. Doiz, Lasagabaster, and Sierra 2013). In post-colonial contexts, however, higher education is far more multilingual (c.f. van der Walt 2013). This multilingual learning, far from being ‘confusing’ as a monolingual perspective would see it, actually opens up higher education to more discourses and has the potential to expand students’ academic mastery of those discourses. As such, translanguaging can develop students’ academic discourses in both Spanish and English, and savvy professors such as Víctor make sure that this happens in their classrooms. This opens doors for bilingual scientists, as Puerto Rican students can be prepared for further study and scientific work in two languages. The strategic pedagogical use of translanguaging, then, can lead to a more just scientific community where access can be given to bi- and multilingual students who can change the face of scientific discourses from within.

Note
1. a pseudonym.

References


