Multicultural Lessons Learned from a Chinese Bilingual After-School Program

Using Technology to Support Ethnolinguistic Children's Cultural Production

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Introduction

In multicultural classroom practices, technology is a power-amplifier tool that teachers can use to "provide multiple approaches to learning for each student" to increase the power of digital artifacts in the learning of science and literacy (Council of Chief State School Officers, 2013, p. 4). Increasingly, both preservice and inservice teachers are expected to transform their instructional activities to engage students in diverse classrooms for a mobile/tablet generation.

Studies exploring some of the ways teachers are using or can use technology in the linguistically diverse classroom document not only the power of technology to engage students in literacy learning but also to support students' cultural production of science (Carlone & Johnson, 2012; Machado-Casas, 2014; Martínez-Roldán & Smagorinsky, 2011; Sánchez, et al., 2014).

This article focuses on how technology can be used to support students' cultural production emerged from the science and literacy learning experience of Chinese bilinguals in an afters-chool program.

New Expansions in Culturally Responsive Teaching

The concept of Culturally Relevant Pedagogy (CRP) has shaped the education of minoritized students in many classrooms (Ladson-Billings, 1995); however, as Ladson-Billings (2014) acknowledges, this pedagogical perspective has also been misused, leading sometimes to fixed notions of "culture." Such fixed notions are very removed from the fluid understanding of culture she originally proposed. Moreover, Leonardo (2013) and Gay (2015) argue that CRP has been appropriated by the language and pedagogy of the right wing (e.g., conservatives) in order to devoid it.

In Gay's (2010) vision of Culturally Responsive Teaching (CRT), responsiveness in classrooms calls for taking social actions (Lew & Nelson, 2016). To employ CRT, it is imperative to reconstruct each of Banks' (2013) five dimensions of Multicultural Education (i.e., content integration, knowledge construction, an equity pedagogy, an empowering school culture, and prejudice reduction), which serve as a foundational pillar for adopting culturally and socially just practices.

There is a dire need for teachers to employ and adopt more CRT approaches. Furthermore, teachers urgently need to realize that the role of CRT is to ground our ethnic minority (and majority) students in understanding the power of knowledge construction (Banks, 2013), and for ethnolinguistic minority students to take ownership in their cultural production. To fully embrace CRT, one needs to ask not only what culture is, but how we are cultured.

For example, Banks (2013) makes the distinction between cultural artifacts and the lens through which we view them. The stand-alone artifacts mean nothing but the lens makes all the difference. Once multicultural educators fully understand this aspect of cultural production, they are less likely to fall into the cultural essentialism paradox. This is somewhat a blend between Nieto's (2009) and Goodenough's (1981) perspectives.

Goodenough (1981) viewed culture as a set of values, rules, and beliefs through which we interpret the world. He made a distinction between public and private beliefs. Nieto (1999; 2009) however viewed culture as ever-changing and dynamic. Nieto states that, at any given time, a person will identify more with one aspect of their culture over another. She also proposes a notion of culture that is learned while at the same time created and socially constructed, embedded in social contexts, and mediated by social, economic, and political factors.

These scholars start off with recognizing the individual, and move on to how that identity makes sense of the world. This movement from individual actions to collective group sharing of meaning helps us to regard cultural production as a plausible new expansion in CRT, to be used to further understand the intangible role of culture in cultural production of science education (Carlone & Johnson, 2012). It is within this expansive notion of culture that we approach the role of technology in our afterschool sessions.

Technologically-Mediated Cultural Production

Carlone and Johnson (2012) indicate that past cross-cultural studies are conceptualized in the orientation of cultural

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differences which may be grounded in cultural relativism and cultural essentialism. They argue that a cultural production paradigm may provide more reflexes and vicarious experiences to understand Funds of Knowledge, defined by Moll, Amanti, Neff, and Gonzalez (1992) as "the historically accumulated and culturally developed bodies of knowledge and skills essential for household or individual functioning and well-being" (p. 133).

According to Carlone and Johnson (2012), cultural production of science is when "individual actions reveal something about a group's shared meanings" (p. 157) in everyday practices that, in turn, produces and/or counters historically-bearing cultural narratives. In utilizing the technologically-mediated cultural production approach, students can bring their Funds of Knowledge to the classroom to contribute to discussions more freely. In addition, by engaging students' Funds of Knowledge, teachers also create opportunities for family members to participate in the student's education across space and time.

Mercado and Moll (1997) enlisted teachers to engage students' Funds of Knowledge and to conduct home visits. When teachers have a large class, it would be nearly impossible to visit every single household. One way of overcoming this shortfall is to send digicams (mini-camcorders) for the students to bring home and equip students with sufficient skills to operate the devices independently. This also opens another avenue for teachers to design their classroom assignments to get to know their students better. In other words, bilingual educators working in multicultural classrooms can personalize their professional learning in their given contexts.

When Chinese bilingual teachers aim to describe the pedagogical value of cultural resources, their use of this multimodal approach in the multicultural classroom makes the learning and technology more comprehensive by attempting to find out what the students' family life narratives are and what kind of Funds of Knowledge come from their households.

According to Carlone and Johnson (2012), analyzing science learning through the lens of cultural production assists Chinese bilingual teachers to allow their CRT pedagogical decision-making to emerge from the students' Funds of Knowledge in particular, as opposed to prior knowledge in general. In the engagement of the technologically-mediated cultural production, students could also use analytical skills to construct their life narratives, formulating new questions.

Epistemologically, most of the attention has been given to the Latino/a community in the field of bilingual education (Mercado & Moll, 1997); including critical scholarship that has examined bilingual students' learning experiences by Latina theorists (c.f., Chicana Feminist Theory, Borderlands Theory). Yet, little is known about the experiences of bilingual content (e.g., science) learning and teaching in Chinese.

Hence, this article aims to shed some light on understanding how technology-mediated learning took place in a Chinese dual language setting. In what follows, we will first describe how technological tools such as iPads, digicams, and Wikispaces were used in a Chinese bilingual afterschool program located in a New York City elementary public school to meet the Next Generation Science Standards (NGSS). Then, we will discuss the multicultural teaching implications with a focus on the new expansions of technologically-mediated CRT.

Case Study: Little Stars Chinese Bilingual After-School Program

This qualitative case study (Merriam & Tisdell, 2015) is part of a larger research project through which six bilingual pre-service teachers participated in one semester of the Little Stars after-school program at a local partnership public school serving Chinese-speaking English Learners.

The focus of the Little Star after-school program was on using technology (namely iPad, digicams, and Wikispaces) to promote the education of bilingual children in science while developing Chinese literacy. With the advent of the NGSS and the Common Core State Standards in English Language Arts & Literacy, there has been a return to the development of teachers' instructional skills in and depth and breadth of technological pedagogical content knowledge in the Interstate Teacher Assessment and Support Consortium (inTASC) Standards.

Hence, the research team chose the grade-level *NGSS Standard 3: Interdependent Relationships in Ecosystems: Environmental Impacts on Organisms* and explored topics about animals, habitats, and (urban) ecosystems in relation to the above-mentioned social practices (Fairclough, 2003).

Theoretical Framework

Guided by Cultural-Historical Activity Theory (CHAT), the after-school curriculum was analyzed through a sociocultural lens, where Chinese bilingual children's vicarious science learning experiences were mediated digitally and understood as social practices and cultural production. The triangular model of an activity system proposed by CHAT theorists (Engeström, 2016, 2017) consists of a subject (or actor), an object or motive for the activity, mediating artifacts (tools), rules, community, and division of labor or roles.

These theoretical perspectives conceive technology not only as a mediating tool and artifact supporting individual learning, but as mediating and being mediated by an activity system that involves rules (when and for what purposes it is used) and roles (who has access to it).

For instance, Martínez-Álvarez (2016; 2017) has discussed the role of digital comics for Spanish-speaking bilingual children and how the digital artifacts allow immigrant pupils to create and negotiate their "hybrid third space" (Gutiérrez, 2008) by narrating their everyday literacy practices on iPads, including taking advantage of multimodal note-taking apps with annotation features, such as audio recording and photo-taking, to tell their own stories.

Furthermore, science education researchers also have articulated the benefits of using documentaries to leverage the cultural knowledge of bilingual children in classroom teaching (Barton, Drake, Perez, St. Louis, & George, 2004; Furman & Barton, 2006).

This line of inquiry is illustrated in Martínez-Álvarez's studies (2016, 2017) in which bilingual children who participated in afterschool programs were asked to use mini-camcorders to make a recording of someone doing science at home or in their community. The dynamic responses captured by the bilingual children, from watering plants to changing light bulbs, portrayed multigenerational family engagement in a valued-oriented scale.

We equipped the children in this study with technological tools (e.g., iPads, apps, digicams, Wikispaces), designed technology rules (e.g., lessons developed leading to inquiry-based research), and distributed technology roles (e.g., breaking the boundaries of formal and informal learning) in afterschool sessions. In so doing, we attempted to explore the Chinese bilingual children's cultural, historical, social, and linguistic Funds of Knowledge production.

Methods

We used Critical Discourse Analysis (Fairclough, 2003) to address a social problem in the cultural production of science education and involved a micro-analysis of Chinese language practices (written and spoken) within technological interactions at a meso-level, thus creating meaning analyses that were specifically designed to reveal connections between micro- and macro-levels, and then an analysis, in turn, within a contextual macro-level of Chinese bilingual education.

Table conversations and whole-class discussions from eight after school sessions were audiotaped and transcribed. Class activities captured on mobile/tablet devices, screenshots of iPads, and photos from digicams uploaded onto Wikispaces were further studied, observation field notes were taken, and classroom-generated artifacts were collected.

Participants

Six Chinese bilingual preservice teachers (PST) volunteered to lead the afterschool sessions with assistance and support from the faculty team leading the project. A total of 15 Mandarin/English bilingual third graders were signed up by their guardians for the Little Stars afterschool program free of charge.

Findings and Discussions

Technologically-Mediated Tools, Rules, and Roles

Three main new perspectives based on the expansion of technologically-mediated CRT emerged from the data analysis. The pre-service teachers (1) used technology as mediating *tools* to promote bilingual children's use of Chinese literacy, (2) they designed technology *rules* that encouraged children's participation in science learning, and (3) there was a distribution in technology *roles* to engage children's cultural production.

Technologically-Mediated Tools to Promote Children's Use of Chinese Literacy

For many bilingual children in the United States, learning how to be literate in Chinese can be a frustrating and daunting task due to its historically developed orthography principles. Attempting to make this endeavor more pedagogically, technologically, and visually interactive, Chinese teacher educators have suggested teachers make good use of the stylus on iPads (Chen, Wang, & Cai, 2010).

In the Little Stars after-school program, our bilingual children reported that they enjoyed writing Chinese on iPads with either their fingers or stylus pens, as opposed to typing from the desktops/laptops. It seems for younger emergent Chinese bilinguals, this authoring and social marking process provided them with more opportunities in and ownership of their change of stroke orders and colors, in contrast with merely selecting the "print script" to conform to specified accuracy. Figure 1 demonstrates the digitally mediating Chinese writing in progress:

These two students were talking to each other and were trying to find a way to write on iPad. The first student went for the conventional pinyin method and encountered some spelling difficulty, the second student wrote it with her finger.

Additionally, iPads allow different methods of Chinese input. The bilingual children can choose to *write-to-type*, meaning that as they generate their penmanship stroke-by-stroke, there is a list of characters associated with constructions of the detected stroke order shown on the side bar or above their writing space for the authors to choose from.

We observed that, in the use of iPads, some advanced emergent bilingual students in the after-school sessions initially preferred this extra recognition process to the default recording of their own writing. We speculate that because this input method involves sophisticated knowledge to tell the different characters apart, the children may have felt that they were also being interactively challenged. Figure 2 captures the interaction between the Chinese bilingual PST and the student.

The student found a homophone with the same sound and tone and asked the PST if it was identical as her surname and they together found a way to the academic term for carnivore in Chinese.

When tensions arose from the above mentioned Chinese input method—for instance, when children found themselves to be too slow in the recognition process or when the characters were too complex—the kids tended to opt for another way to denote their Chinese writing digitally that required correct processing of the sound and tonal system in Chinese, such as Pinyin or phonetic symbols (i.e., *bo po mo fo*) with the right choice of tone mark as it appeared on the screen, although it could sometimes be quite limiting for speakers of Chinese dialects with different registers. The temporary solution was for them to narrate their sentences, using an authentic voice recording app.

During the after-school sessions, we found a different aspect of translanguaging practices (García & Li, 2014) when emergent Chinese bilinguals worked with the transliteration practices, which

Figure 1
Writing Chinese on iPads

Chinese Excerpt	English Translation
S1: 可是那個太難打了。捕食者，者怎麼寫？太難了，z-h-i̱ 吧？	S1: But that word is too hard to type it up in pinyin, bu3shi3zhe3 [English word: predator], how do you spell the character, zhe3, in pinyin? It is just too difficult, maybe it is z-h-i̱?)
S2: 我寫，我寫了	S2: I wrote it, I am done!

Figure 2
Interaction between the Teacher and the Student

Chinese Excerpt	English Translation
S: 肉食性	S: rou4shi2xing4 (English word, carnivore)
T: 那你就寫食啊	T: Then you can just write this character "shi2"
S: 石是不是這樣？	S: does the character "shi2" look like this?
T: 是食物的食，不是石老師的石，你看這個字，就是這個字，你可不可以大概模仿一下。因為這個電腦很聰明，如果你寫的差不多的話...	T: Oh, it is the shi2 as in shi2wu4 (English word, food), not the shi2 of Ms. Shi2. Look at this character, this is it, can you approximately write the character there? This iPad is very smart, if you write it almost the same, it can...
S: I think it is, I think it is like that and that and that...	S: (original) I think it is, I think it is like that and that and that...
T: 對啊，你看，你寫對了啊。肉食性 。	T: Perfect, you see, you write it correctly. It's rou4shi2xing4 (English word, carnivore)

was to form Romanized letters to get the corresponding Chinese characters in texts. Figure 3 from the table transcript showed such alternative translanguaging practice.

We argue that this transliteration literary practice enlarges our new understanding of translanguaging because both the written and spoken Chinese languages were rendered as such. This transliteration in translanguaging practices in Chinese bilingual communities are most notably known in the family terms these bilingual children used in their household when they narrated their science learning.

For instance, a child shared with us during snack time, "I like dogs, but my meimei is scared of fur animals." This sentence was written in English in original and meimei, a sibling term that refers to the younger sister in a Chinese household, was recorded in its Romanized form instead of Chinese characters.

Technologically-Mediated Rules to Encourage Children's Participation in Science Learning

Since each table only had one iPad, the group members learned to negotiate their turn-taking. They also helped each other to discover the utility of iPads and other electronic devices brought and introduced to them in the afterschool program. The PST had in mind to maximize the use of Chinese language and exposures.

The Chinese bilingual children, in turn, modeled that practice amongst themselves. As a matter of fact, the children even exercised their agency by asking the table teachers if they could sign their names next to their choice of animals on iPads. They also made science reports directly on a note-taking app.

Students at each table generally produced more Chinese language in terms of taking technology-oriented actions. Figure 4 is an example from the research write-up discussion among the PSTs and the table students.

Moreover, in one of the card games of classifying animals, a recent immigrant child shared an insight with her group members that they could consider the label of international or non-international. When she was asked to give a reason, she further shared, "because [a] panda is an international animal." Her transnational association is salient in storying her identity (Roth, 2007). Many of her peers at the table agreed with her comment and were also able to relate to that new classification.

Additionally, the table teacher from the same group was able to make the specific point that ethnolinguistic child wanted to get across to engage everyone in extending more culturally productive conversations in their learning of science.

On the topic of using children's literature to enhance scientific knowledge about animals, we chose the storybook *Stellaluna*, to introduce the concept that bats are mammals and prepare the children for their own expert reports to be published on Wikispaces. During the digitally mediated read-aloud, we encouraged the Chinese bilingual children to use their social imagination and visualization strategy to help them describe what they saw in the pictures.

As the story went on, when the lead PST projected one PowerPoint slide from the book where a grasshopper appeared on the Smartboard, one child immediately raised her hand and responded in Chinese, "It's a green...green...cockroach!" This miscue was picked up by the PST acting as the lead teacher who shared the same speech community. She turned her back to the Smartboard and pointed at the grasshopper and repeated the phrase the child produced and first acknowledged the student's social imagination by saying, "It does look like a green cockroach here! [Does] anyone else know what this insect might be?"

Had the same child supplied the answer to a monolingual English teacher, this kind of cultural production might not have been co-constructed on the same page or been further elicited since the Chinese bilingual children, as any child living in urban contexts, see cockroaches as part of their urban ecosystems. We see that technology as rules was enacted as the Chinese bilingual children together with the Chinese PSTs moved through the purposeful (re)negotiations of the use of digital artifacts.

Figure 3
Transliteration in Translanguaging

Chinese Excerpt	English Translation
T: 那我們寫胎生好不好?	T: Then, we will write, viviparous animals, okay?
S1: t-a-r	S1: t-a-r [type in the Pinyin to search for characters]
S2: yes I did it	S2: (original) yes I did it
S1: s-a-n	S1: s-a-n
T: s-h	T: s-h [trying to sound out the retroflex initial for S1]
S1: s-h-a-n	S1: s-h-a-n [trying to make a guess for the ending rhymes]
T: 胎生(viviparous animals) s-h-e	T: viviparous animals. s-h-e [trying to spell out the retroflex initial for S1]

Figure 4
Research Write-up Discussions Among the PSTs and the Students at the Table

Chinese Excerpt	English Translation
T1: 好，謝謝。我們現在把你寫的東西放在iPad裡面好嗎？完了把東西貼上去	T1: Okay, thank you, now we are going to publish your writing on the iPad okay? Once you are done with your typing, paste your response there
T2: 對，更大的魚吃小丑魚	T2: Right, bigger fish eats clown fish
S1: 最後一個	S1: Last one!
S2: 你看你寫給我	S2: Look, the one you wrote for me...
S1: 這個怎麼這個奇怪啊	S1: How come this character seems so weird!
S2: you can't do it. 你可以寫	S2: (original) you can't do it. You can write this one instead...
S3: 漂亮的魚。老師，給你看魚，兩個魚。	S3: Beautiful fish. Teacher, see the fish, there are two fishes
T1: 哦，好可愛，怎麼了？	T1: Oh, that's cute. What's the matter?
S2: this happens [pointing at the iPad screen]	S2: (original) this happens [pointing at the iPad screen]
T1: 哦，没關係，我會幫你貼好，没有關係。	T1: Oh, that's okay, I will paste it for you on iPad, that's okay
S2: 可，可，可，可以寫這個嗎？	S2: Can... can... can... can I write this?
T1: 可以啊，我寫給你看，可是我寫完一遍你要再寫一遍好嗎？	T1: Sure, I can show you how to write it, but after my demo, you would need to write it again by yourself, okay?

Technologically-Mediated Roles to Engage Children in Their Cultural Production

In addition to the development of urban ecosystems, the students were instructed in the inquiry-based Little Stars after-school program to do research on their favorite animals; that is, we wanted to make available for them the role of inquirers through the use of technology and they embraced that role. When one of the children found that pandas used to be carnivores, she was surprised and excited to share this fact with her group mates and, later on, her designated Wikispaces page.

The digital publication party at the end of the semester with the family members was successfully planned where the children were also invited to generate collaborative urban ecosystem collages at the tables. They took the digicams home and photographed their communities where they learned about the academic key concepts.

In their sharing of urban ecosystems, we had learned more about their cultural production in science learning from examples of raising fish in the fishbowl, feeding pigeons they chased after in the park, and noticing rats running around in the subway tunnels. They were also able to articulate why they chose to share such examples in the urban ecosystems and their interdependent relationships.

It is noteworthy that we found a few instances in which the children mentioned their Chinese zodiac animals. Although they were not a major curriculum component nor covered in the lessons offered in the afterschool program, another concrete example of cultural production might be the twelve Chinese zodiac animals: a combination of agricultural contributors (rooster, cow, horse, sheep, rabbit, dog, pig), some pesky, vicious, or less-welcomed characters (rat, snake, tiger), and one ancient mythical creature (dragon).

This Chinese sentence, *Wo Shi (or Shu) Zhu*, literally "I am (or belong to) Pig," is grammatically correct, but someone not from the Chinese bilingual community might not capture the intent of cultural production as the children shared their characteristics, personalities, and identities intuitively. Virtually no studies have examined Chinese zodiac animals in the context of science education. Chinese zodiac animals chiefly appear in Chinese literature studies at the graduate school level as language-arts instructional activities to teach symbolism at the secondary education level, or as community-building activities in the lunar New Year's celebration at the elementary school level (Dulfano & Kwan, 2007).

We argue that this body of cultural ways of knowing has valuable productivity in Chinese bilingual science education in multicultural classrooms for future studies, by utilizing technology to make available a range of roles for the children, including the role of culture producers.

Conclusion

Utilizing technologically-mediated CRT, the Chinese bilingual pre-service teachers who participated in this afterschool program learned more about the power of technology to support students' Chinese literacy and also about the emergent bilinguals they worked with on a weekly basis.

Regarding the power of technology, they were able to design pedagogical practices in which technology not only served as a tool for children's literacy learning, but in ways that supported students' academic identities as the children envisioned new roles for themselves as inquirers and writers (while the preservice teachers embraced the role of teacher and learner). The distribution of labor in which the children became agents and at some times "teachers" for each other and in which the preservice teachers learned from the children reminds us of Freire's (1970) vision in which both (adults and children) are simultaneously teachers and students.

The preservice teachers also learned a great deal about their students. From the alternative digital storytelling conducted in the homes of the immigrant students, new kinds of relationships were built between teachers and family members that broke the boundaries of formal and informal learning.

This new expansion of CRT demonstrates how innovative digital mediation not only utilizes immigrant students' Funds of Knowledge but also benefits the entire after-school classroom and serves as a unique and dynamic learning experience. We interviewed the guardians and found that participants in this after-school program generally viewed in a positive way especially with respect to the ethnolinguistic minority students' self-efficacy in an English-speaking dominated discourse, particularly because they were able to produce culturally in their science learning in their home languages and beyond.

Note

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