English through Inquiry: Implications of WIDA for Secondary Science Education Professional Development

CATHERINE D. BHATHENA,
Indiana University, Indianapolis

The adoption of the WIDA standards in Indiana provides the state with an opportunity to create professional development for secondary science teachers that could transform how English language learners in the state of Indiana learn science. A review of recent literature in both language and multicultural education indicates inquiry can be used as a framework to structure such professional development, with special attention to how science teachers address academic language development, contextualize content to students' prior knowledge, and, perhaps most importantly, design instruction that allows students to question the status quo in science knowledge and practice. Such transformation could lead to student science learning that exceeds the expectations outlined in Indiana's English language development standards and state science standards.

Keywords: WIDA, multicultural education, science education, academic language development, professional development, inquiry, equitable education

Introduction

This mandate for change is both simple and profound. It is simple because it demands for ethnically different students that which is already being done for many middle-class, European American students—that is, the right to grapple

> with learning challenges from the point of strength and relevance found in their own cultural frames of reference. It is profound because, to date, U.S. education has not been very culturally responsive to ethnically diverse students. Instead these students have been expected to divorce themselves form their cultures and learn according to European American cultural norms. This places them in double jeopardy—having to master the academic task while functioning under cultural conditions unnatural (and often unfamiliar) to them (Gay, 2002, p. 114).

Educating English language learners (ELLs) in secondary classrooms is a complicated endeavor (Janzen, 2008; Calabrese Barton & Lee, 2006; Buck, Mast, Ehlers, & Franklin, 2005). Not only are there language issues to be addressed, but issues of student context such as race, culture, class, and gender (Bashir-Ali, 2006; Taylor, 2006; Kumaravadivelu, 2003; Kubota, 1999; Spencer & Lewis, 1986); addressing these issues is critical for enacting the mandate for equitable education for all learners that Gay (2002) describes. While the current literature has identified this complex task, most research on how to prepare teachers to address it has focused on elementary school settings (e.g. Stoddart, Bravo, Solis, Mosqueda, & Rodriguez, 2011; Lee, Lewis, Adamson, Maerten-Rivera, & Secada, 2008), leaving a gap concerning how to best address this complex task in secondary science classrooms. This is important because it is at the secondary level that students encounter an increase in content literacy demands within their science courses (Fang, 2006) and high school graduation requirements that include successful completion of three science courses (IDOE, 2015a). Additionally, ELLs in secondary school face the challenge of working to successfully navigate these changes in an unfamiliar language and context (Janzen, 2008; Lee & Buxton, 2008; Case, 2002).

In Indiana, the need to for teachers to address the complex needs of English language learners in their classrooms has increased dramatically in the last two decades. As of 2008, Indiana had the second fastest growing ELL enrollment in the United States; second only to South Carolina (Batalova & McHugh 2010). In fact, the ELL student enrollment in Indiana increased over 400% between 1998 and 2008 (Indiana Department of Education (IDOE), 2013). However, it is only recently that the topic has entered local media coverage (i.e. Elliot, 2015; Wang, 2015; Zubrzycki & Colombo, 2015). Much of this coverage has highlighted the impact of increased numbers of ELLs on state standardized test scores (Elliot, 2015) and the changes a few Indianapolis schools are implementing to address this impact (Zubrzycki & Colombo, 2015). Although some reports have shared stories of students and families who are negotiating school systems amidst teachers and students who do not understand the challenges they face to master academic content while learning English and adjusting to Indiana school and social cultures (Wang, 2015), most of the focus has been on accountability measures.

Regardless of the perspective of the individual stories, the overall message now reaching schools via newspaper and radio concerns the need to increase their attention to how they educate the growing number of students from diverse language and cultural backgrounds in order to raise test scores; and while scores on state science tests do not currently play a role in accountability measures (Indiana Register, 2015), graduation rates do (IDOE, 2015d). So, successful science teaching and learning for ELLs is crucial for students, teachers, schools, and districts. This is further emphasized by Indiana's adoption of new English language proficiency (ELP) standards and the accompanying language proficiency exam that includes a focus on science language and content.

The newly adopted WIDA standards (IDOE, 2015b) increase Indiana's focus on academic language proficiency in science classrooms. Along with the standards, Indiana adopted the ACCESS® for ELLs (ACCESS) test as the state standardized measure of English language learning (IDOE, 2015b). This is the test that will now be used in the calculation of Annual Measurable Achieve Objectives (AMAOs) required by the *No Child Left Behind Act of 2001*, an accountability measure that impacts individual school and corporation funding as well as state determined letter grades (Indiana Register, 2015). Science teachers' work in the classroom will impact ELL performance on the ACCESS test because, unlike its predecessor, the LAS-Links test, the ACCESS test includes items specific to measuring the standard of academic science language proficiency (WIDA Consortium, 2008).

The WIDA science standard states, "English language learners communicate information, ideas and concepts necessary for academic success in the content area of science" (WIDA, 2012). However, it does not provide individual indicators for science teachers to use in implementing this standard in their lesson planning and instruction. Instead, WIDA provide tools such as the Can Do statements, performance definitions, and Model Performance Indicators (WIDA, 2014) that teachers use to scaffold their own state content standards to meet the language needs of English language learners at all proficiency levels. This results in standard indicators that are compatible with Indiana state science standards and local curriculum, but that also assume the teachers using them have a basic level of understanding of how language is learned and how to teach literacy skills in science.

This assumption of basic knowledge on the part of most science teachers is not born out by research findings. In fact, various researchers have documented the lack of science teacher preparation to meet the content language learning needs of ELLs (e.g. Suriel & Atwater, 2012;

Reeves, 2010) and that many secondary teachers continue to see language and content as two distinct subjects, taught in two distinct courses (Huang, 2004), instead of being the responsibility of all teachers in all classrooms. This latter viewpoint is the one taken by the IDOE in its statement concerning the adoption of the WIDA standards:

> All educators with English learners in their classroom are responsible for utilizing the WIDA standards and framework to ensure equitable access for all. We must ensure the ELD standards and Indiana Academic Standards are used collaboratively to create a continuous pathway to academic success for Indiana's English learners. (IDOE, 2015b)

Thus, given the lack of preparation of many secondary science teachers to teach ELLs and the increasing numbers of ELLs in Indiana schools, extensive professional development (PD) for science teachers will be required across the state in order to prepare them to provide "equitable access for all." In order for this professional development to address the complexity of teaching science to ELLs, it will need to address academic language learning *and* student context in science education. This paper will first summarize existing literature on both of these topics including how they intersect in the secondary science classroom. This will be followed by a discussion of how the implementation of WIDA standards in Indiana provides opportunities for research in coordination with professional development opportunities for teachers.

Academic Language Learning and Student Context in Science Education

Two previous reviews of the literature concerning English language learners (ELLs) in science classrooms were conducted by Lee (2005) and Janzen (2008) and focused on considerations of academic language learning and student context. Lee (2005) reports that within the topic of science learning there was mixed evidence on the importance of considering students' backgrounds when teaching science in the classroom; however it was generally evident that "when instruction is in English, ELLs' science learning is in direct relation to their level of English proficiency" (p. 500). This finding indicates that for ELLs, literacy instruction is of vital importance. This is reinforced by Janzen's (2008) pedagogical findings that identified specific successful literacy practices in working with ELLs in secondary science classrooms: practices that have been reinforced and built upon by recent research in language and multicultural education in secondary science classrooms. The importance of such practices in considering professional development for teachers preparing to implement WIDA standards is that teachers must move beyond simply implementing the practices to understanding *why* they work for ELLs, a point frequently left unsaid in the literature.

Inquiry is the Key to ELL Student Success

Inquiry in Indiana science classrooms is most clearly seen in the process standards used in conjunction with content knowledge standards (IDOE, 2015c) and is integral to science teaching in the state. Through inquiry students have the opportunity to develop academic literacy that addresses both language learning and student context by using academic language in classroom interaction (Johnson, 2011; Atwater, 1996; Atwater, 1994); connecting science with literacy, prior academic knowledge, and lived experiences (Janzen, 2008; Lee, 2005; Moll, L. C., Amanti, C., Neff, D., & Gonzalez, N., 1992); and questioning the status quo in science knowledge and practice (Suriel and Atwater, 2012). All of these are crucial for diverse students who are learning English.

Using academic language in classroom interaction. English language learners need to receive comprehensible input through meaningful interaction (Krashen, 1982). Recent research has demonstrated that this is essential in the secondary science classroom for increased ELL student learning. In activity design, collaborative small group and pairing strategies (Lara-Alecio, Tong, Irby, Guerrero, Huerta, & Fan, 2012; Matthews and Mellom 2012) with explicit attention to oral language development demonstrated a positive impact on student test scores on district benchmarks in science and reading. Because collaboration of this kind includes both teacher-student and student-student collaboration, the classroom structures and curriculum focused students on discussion of content using academic vocabulary and discourse (Johnson, 2011; Atwater, 1996; Atwater, 1994). For example, in her case study of two teachers working with Latino students, Johnson (2011) found that use of cooperative learning and small group work led to valuing different cultures and opinions, building a supportive classroom community, and increasing the motivation to learn science. Therefore, use of such collaboration not only addresses language development needs for ELLs, but also allows for student cultural influences on interaction patterns in the classroom (Gay, 2002, p. 111), partially due to the influence of "communal cultural systems of African, Asian, Native, and Latino American groups" (p. 112) represented in many ELL populations across Indiana. Yet, this cultural influence may contradict the school culture that typically enforces an active speaking role (teacher, usually, or student who has been "called on" by the teacher) and a passive listener role (everyone else). Such a school culture can be at odds with students whose cultures see the roles of people in communication as more fluid and verbally engaged. Therefore, inclusion of students' cultural communication patterns in the science classroom can prevent students being "intellectually silenced" and having "their thinking, intellectual engagement, and academic efforts . . . diminished as well" (Gay, 2002, p. 111). Thus, support is strong in both language and multicultural education research in science for collaborative learning in the classroom through inquiry activities.

Connecting science with literacy. Inquiry lessons designed with a focus on literacy assist students in connecting their developing language skills with science content (Lee, 2005; Amaral, 2002). The daily inquiry lessons Lara-Alecio, Tong, Irby, Guerrero, Huerta, and Fan, (2012) included in their study followed the 5-E instructional cycle (Engage, Explore, Explain, Evaluate, & Elaborate) to guide students through "lesson plans [that] were tightly aligned to state science standards, national science standards, and English language proficiency standards" (p. 995). Such inquiry activities provide students with the opportunities to use science language in a way that is contextualized within academic content (Lee & Buxton, 2013), leading to the use of language functions, such as describing, classifying, and interpreting that are integral to creating WIDA Model Performance Indicators. Use of the language functions in conjunction with science skills such as formulating hypotheses, collecting and interpreting data, and drawing conclusions (Lee & Buxton, 2013) ensure ELLs are meeting the same Indiana state science requirements as their native English speaking peers.

In contrast to the tightly designed and teacher-led lessons of Lara-Alecio, et al.'s (2012) study, Clark, Touchman, Martinez-Garza, Ramirez-Marin, and Drews (2012) used a student-directed inquiry project in an online environment that permitted students to navigate the online environment in their own way, with the students in the experimental group having access to native language supports not available to the control groups. Clark, et al. (2012) found that students who had access to native language supports in the online environment retained information better than their English-only counterparts, as demonstrated on a delayed post-test. Additionally, the students did equally well on a native language delayed post-test as compared to the English one, so the native language supports did not hinder their English language production on the delayed-post test (p. 1219). This supports established research on the interactions of native and new languages (e.g., Cummins, 1979) and demonstrates the possibilities technology offers for teachers to provide native language support to students from many different linguistic backgrounds as are frequently found in Indiana schools.

The benefits of such native language supports were corroborated in studies by Matthews and Mellom (2012) and Gerena and Keiler (2012). These studies documented use of native language to assist students in understanding content area vocabulary. In the study by Gerena and Keiler (2012), native language use was enacted by untrained, bilingual Teaching Assistant Scholars (TAS) who had themselves been English language learners and reported using the strategy, among others described below, because they had remembered it being useful as they, themselves, learned academic English (p. 91). Utilization of native language in both studies was also helpful in connecting student understanding of science concepts in English to prior knowledge in their home languages.

Connecting science with prior academic knowledge and lived experiences. Intentional connections between concepts in secondary science and students' prior knowledge can be made through the use of graphic or advance organizers (Berg & Wehby, 2013; Lee & Buxton, 2013, Gerena & Keiler, 2012). These organizers connect content within the current unit of study and also help connect new content to prior academic knowledge, in any language, to enhance learning (Berg & Wehby, 2013; Gerena & Keiler, 2012). Decapua and Marshall (2010) specifically designed a model for addressing the learning needs of students with limited and interrupted formal schooling that relies heavily on such connections. This model includes "immediate relevance and interconnectedness," asking teachers to explicitly connect content to student's lived experiences in their homes and communities (p. 54). Such connections assist teachers in understanding "the complex dynamics between scientific practices and students everyday knowledge" (Lee, 2005, p. 506) and in recognizing when student cultures can be resources for learning classroom science and when they may be in conflict with the school culture. (Janzen, 2008). Such recognition is paramount to pushing ELLs past textbook inquiry and into critical inquiry.

Questioning the status quo in science knowledge and practice. One way to begin such critical inquiry is through developing effective communication with the communities where students live through positive interactions with parents and families and participation in community action projects, as Johnson (2011) describes in her study. In this study communication with the community resulted in teachers' ability to connect science learning to students' contexts beyond the classroom and academics, shifting roles of student and teacher and giving students more voice in their learning.

Atwater (1996) declares the need for student voice in science education research and questions the role of science teacher as authority figure and decision-maker in both multicultural and monocultural classrooms. Bringing this voice to both research and practice involves a need to shift student and teacher roles to become more of a caring partnership (Valenzuela, 2013; Gay, 2002). Valenzuela describes the importance of such partnerships for Latino students as related to the idea of being *bien educado/a* (well-educated), meaning "to not only possess book knowledge but to also live responsibly in the world as a caring human being, respectful of the individuality and dignity of others" (p. 295). Such caring partnerships are described by Gay (2002) as "a moral imperative, a social responsibility, and a pedagogical necessity" in culturally responsive pedagogy (p, 109). From the teacher point of view, Johnson's (2011) study documented such a change in teacher role when one of the teachers stated that "his shift to 'being a facilitator and not a dictator' was one of much pleasure" (p. 194), which then allows teachers to also shift their perspective to setting high expectations for every student in the room. Once the expectations are clear, teachers can then design instruction that scaffolds every student's attainment of those expectations, without exception (Gay, 2000, p. 109), because the teacher truly cares for each student.

Development of such caring partnerships between students and teachers expands science instruction to include "diverse perspectives on important social and cultural questions surrounding scientific concepts" (Suriel & Atwater, 2012, p. 1280). Such practice allows for discussion and investigation of "how marginalized people use their scientific knowledge and how they have contributed to the worldwide body of knowledge" in order to examine the social and political landscape and "become advocates for an equitable society" (Suriel and Atwater, 2012, p. 1280). This is particularly relevant for students whose home language, knowledge, and experiences may conflict with the science knowledge as presented in state standards (Janzen, 2008). Additionally, this moves science instruction away from being what Valenzuela (2013) describes as "subtractive schooling," (p. 292) that seems to ignore or even attempt to erase students' prior knowledge and experiences and moves it towards incorporating student context into secondary science classrooms. In this way students and teachers become partners in the creation of knowledge and recognize the importance of science understanding beyond the concepts found in the standards, while at the same time building "authentic caring" (Valenzuela, 2013, p. 296) relationships into the classroom community.

Implications for WIDA implementation and Professional Development in Indiana

Indiana's introduction of the WIDA standards brings with it the question of how best to engage secondary science teachers in the complex task of teaching science to ELLs. An examination of WIDA's various documents demonstrates that while the Can Do Philosophy acknowledges the important role of culture, experience, and social and emotional assets in student academic language development (WIDA, 2014), the tools provided for teachers to implement instruction with ELLs focus almost exclusively on students' linguistic needs, with little attention to these other aspects of science learning (Wisconsin Center for Educational Research, 2012, December; Wisconsin Center for Educational Research, 2012, May). This indicates a need for teachers, districts, and professional development providers to incorporate a variety of materials, resources, and research in conjunction with WIDA materials when preparing professional development opportunities for secondary science teachers in order to address both English language learning *and* student context in science classrooms.

To do this, the literature in both language and multicultural education in secondary science indicates that professional development can center its design on the use of inquiry in the classroom. Thus, inquiry becomes the framework to integrate the practices described here that are crucial for ELL student achievement, namely using academic language in classroom interaction; connecting science with literacy, prior knowledge, and lived experiences; and questioning the status quo in science knowledge and practice. The actual design of the professional development is a local undertaking, as each district and school has its own unique ELL population. The design of such local PD efforts offers opportunities for teacher-researcher and university-school partnerships to identify what teachers in a specific locale need to learn about their ELL populations; design ways to gather the information and build relationships with ELLs, their families, and their communities; and then provide on-going, in-classroom support to develop curriculum and instruction that incorporates what teachers learn. This would create professional development with practicing science teachers that brings together language development and student context in order to ensure student learning and success in secondary science.

Additionally, such professional development would include opportunities for investigation into gaps in the current literature. Although there is a growing amount of research on multicultural education in secondary science, most of the research into such PD concerning the intersection of academic language instruction and student context has occurred in the elementary school context (e.g. Grimberg & Gummer, 2013; Stoddart, Bravo, Solis, Mosqueda, & Rodriguez, 2011; Lee & Luykx, 2005), with little having been conducted that is specific to English language learners in secondary science classrooms. Therefore, more research is needed concerning how to prepare secondary teachers to respect student linguistic and cultural knowledge and use it as a resource in the science classroom. In particular, considering the implementation of the WIDA science standard in Indiana secondary classrooms, some potential areas of study, drawn from Gay (2002), might include: determining cultural and linguistic strengths and weaknesses of curriculum and instructional materials; making changes to meet student needs; connecting to context (p. 108); avoiding simplification of topics via a facts-only approach by teaching the topics' complexity of content (p. 109); including many voices and perspectives beyond the commonly known "heroes" in science such as George Washington Carver or Ellen Ochoa; and finally identifying and addressing the stereotypes perpetuated by representations (or lack thereof) of cultural groups within the curriculum and mass media related to science (p. 109) as a means for questioning the status quo and connecting to students' lived experiences. While Gay (2002) emphasizes that all of these can be learned (p. 113), Suriel and Atwater (2013) showed that intentional instruction in multicultural education strategies had an impact on teacher curriculum development practices. Therefore, as Indiana works to put the

WIDA standards into practice in science classrooms, such approaches from multicultural education should be included in science teacher professional development.

Furthermore, with the adoption of the WIDA standards, Indiana is positioned to show nationwide leadership in their development of an equity-minded teaching force. If the state takes up the challenge in secondary science education, professional development could be designed and enacted that works deeply with teachers to change their practices with regard to educating English language learners. Changes in how science teachers address academic language development, contextualize content to students' prior knowledge, and, perhaps most importantly, design instruction that allows students to question the status quo in science knowledge and practice could lead to student science learning that exceeds the expectations outlined in both language development and science state standards documents.

ABOUT THE AUTHOR

Catherine (Cathy) D. Bhathena is Project Manager for IUPUI ESL Partnerships National Professional Development Grant and a doctoral student in the Urban Education Studies program at Indiana University School of Education at Indianapolis. Prior to working at IUPUI, Cathy was an environmental educator in the Peace Corps and at World Wildlife Fund, a middle school science teacher in New Rochelle, New York, and a secondary ENL teacher and coach in Indianapolis Public Schools. Her research interests include teaching English language learners in science classrooms, critical multicultural education, race, and curriculum theory.

Inquiries should be directed to cdfuller@iupui.edu

REFERENCES

Amaral, O. M., Garrison, L., & Klentschy, M. (2002). Helping English learners increase achievement through inquiry-based science instruction. *Bilingual Research Journal*, *26*(2), 213-239.

Atkinson, D. (1999). TESOL and culture. *TESOL Quarterly*, *33*(4), 625-654.

Atwater, M. (1994). Research on cultural diversity in the classroom. In D. Gabel (Ed.), *Handbook of Research on Science Teaching and Learning* (pp. 558-576). New York, NY: Macmillan Publishing Company.

Atwater, M. M. (1996). Social constructivism: Infusion into the multicultural science education research agenda. *Journal of Research in Science Teaching*, *33*(8), 821-837.

Atwater, M. M., Lance, J., Woodard, U., & Johnson, N. H. (2013). Race and ethnicity: Powerful cultural forecasters of science learning and performance. *Theory Into Practice*, *52*(1), 6-13. doi: 10.1080/07351690.2013.743757

Aud, S., Wilkenson-Flicker, S., Kristapovich, P., Rathbun, A., Wang, X., Zhang, J., Notter, L., Nachazel, T., & Dziuba, A. (2013). *The condition of education 2013*. U.S. Department of Education, National Center for Education Statistics.

Bashir-Ali, K. (2006). Language learning and the definition of one's social, cultural, and racial identity. *TESOL Quarterly*, *40*(3), 628-639.

Batalova, J. & McHugh, M. (2010). *Number and growth of students in U.S. schools in need of English instruction.* Washington, DC: Migration Policy Institute.

Buck, G., Mast, C., Ehlers, N., & Franklin, E. (2005). Preparing teachers to create a mainstream science classroom conducive to the needs of English-language learners: A feminist action research project. *Journal of Research in Science Teaching*, *42*(9), 1013-1031.

Berg, J. L. & Wehby, J. (2013). Preteaching strategies to improve student learning in content area classes. *Intervention in School and Clinic*, *49*(1), 14-20.

Calabrese Barton, A. & Berchini, C. (2013). Becoming an insider: Teaching science in urban settings. *Theory into Practice*, 52(1), 21-27.

Calabrese Barton, A. & Lee, O. (2006). NARST equity and ethics committee: A call to action. *Journal of Research in Science Teaching*, *43*(9), 875-878.

Case, R. E. (2002). The intersection of language, education, and content. *Clearing House, 76*(2), 71.

Clark, D. B., Touchman, S., Martinez-Garza, M., Ramirez-Marin, F., & Skjerping Drews, T. (2012). Bilingual language supports in online science inquiry environments. *Computers & Education, 58*(4), 1207-1224.

Cummins, J. (1979). Linguistic interdependence and the educational development of bilingual children. *Review of educational research*, *49*(2), 222-251.

Decapua, A. & Marshal, H. W. (2010). Serving ELLs with interrupted or limited education: Interventions that work. *TESOL Journal*, *1*(1), pp. 49-70.

Elliot, S. (2015, April 19). Schools tested by rise in immigrants learning English. *Chalkbeat Indiana*. Retrieved from http://www.indystar.com/story/news/education/2015/04/19/schools-tested-rise-immigrants-learning-english/26041505/

Fang, Z. (2006). The language demands of science reading in middle school. *International Journal of Science Education*, *28*(5), 491-520.

Gay, G. (2002). Preparing for culturally responsive teaching. *Journal of Teacher Education*, *53*(2), pp. 106-116.

Gerena, L. & Keiler, L. (2012). Effective intervention with urban secondary English language learners: How peer instructors support learning. *Bilingual Research Journal, 35*(1), 76-97. doi: 10.1080/15235882.2012.667372

Grimberg, B. I. & Gummer, E. (2013). Teaching science from cultural points of intersection. *Journal of Research in Science Teaching, 50*(1), 12-32.

Huang, J. (2004). Socialising ESL students into the discourse of school science through academic writing. *Language & Education: An International Journal, 18*(2), 97-123.

Indiana Department of Education. (2015a). *Indiana's Diploma Requirements*. Retrieved from http://www.doe.in.gov/ccr/indianas-diploma-requirements

Indiana Department of Education. (2015b). *Indiana English Language Development Standards: WIDA*. Retrieved from http://www.doe.in.gov/sites/default/files/elme/wida-one-pager.pdf

Indiana Department of Education. (2015c). *Science*. Retrieved from http://www.doe.in.gov/standards/science

Indiana Department of Education. (2015d). *A-F Accountability*. Retrieved from http://www.doe.in.gov/accountability/f-accountability

Indiana Department of Education. (2013). *Find school and corporation data reports*. Retrieved from http://www.doe.in.gov/accountability/find-school-and-corporation-data-reports

Indiana Register. (2015). TITLE 511 INDIANA STATE BOARD OF EDUCATION Proposed Rule LSA Document #14-447 DIN: 20150204-IR-511140447PRA Retrieved from http://www.doe.in.gov/sites/default/files/accountability/20150204-ir-511140447pra.xml.pdf

Janzen, J. (2008). Teaching English language learners in the content areas. *Review of Educational Research, 78*(4), 1010-1038.

Johnson, C.C. (2011). The road to culturally relevant science: Exploring how teachers navigate change in pedagogy. *Journal of Research in Science Teaching, 48*(2), 170-198.

Krashen, S.D. (1982). *Principles and Practice in Second Language Acquisition*. Oxford, England: Pergamon.

Kubota, R. & Lin, A. (2006). Race and TESOL: Introduction to concepts and theories. *TESOL Quarterly, 40*(3), 471-493.

Kumaravadivelu, B. (2003). Problematizing cultural stereotypes in TESOL. *TESOL Quarterly, 37*(4), 709-719.

Lara-Alecio, R., Tong, F., Irby, B. J., Guerrero, C., Huerta, M., & Fan, Y. (2012). The effect of an instructional intervention on middle school English learners' science and English reading achievement. *Journal of Research in Science Teaching*, *49*(8), 987-1011.

Lee, O. (2005). Science education with English language learners: Synthesis and research agenda. *Review of Educational Research, 75*(4), 491-530.

Lee, O., & Buxton, C. A. (2013). Teacher Professional Development to Improve Science and Literacy Achievement of English Language Learners. *Theory Into Practice, 52*(2), 110-117.

Lee, O., & Buxton, C. (2008). Science curriculum and student diversity: A framework for equitable learning opportunities. *The Elementary School Journal, 109*(2), 123-137.

Lee, O., Lewis, S., Adamson, K., Maerten-Rivera, J., & Secada, W. G. (2008). Urban elementary school teachers' knowledge and practices in teaching science to English language learners. *Science Education, 92*(4), 733-758.

Lee, O. & Luykx, A. (2005). Dilemmas in scaling up innovations in elementary science instruction with nonmainstream students. *American Educational Research Journal, 42*(3), 411-438.

Matthews, P. H. & Mellom, P. J. (2012). Shaping aspirations, awareness, academics, and action: Outcomes of summer enrichment programs for English-learning secondary students. *Journal of Advanced Academics, 23*(2), 105-124. doi: 10.1177/1932202X12439197

Moll, L. C., Amanti, C., Neff, D., & Gonzalez, N. (1992). Funds of knowledge for teaching: Using a qualitative approach to connect homes and classrooms. *Theory into practice*, *31*(2), 132-141.

Reeves, J. R. (2006). Secondary teacher attitudes toward including English-language learners in mainstream classrooms. *The Journal of Educational Research*, *99*(3), 131-143.

Spencer, M. L. & Lewis, P. G. (1986). Sex equity in bilingual education, English as a second language, and foreign language instruction. *Theory into Practice*, *25*(4), 257-266.

Stoddart, T., Bravo, M., Solis, J., Mosqueda, E., & Rodriguez, A. (2011). *Effective Science Teaching for English Language Learners (ESTELL): Measuring Pre-service Teacher Practices.* Paper presented at the annual meeting of the American Educational Research Association, New Orleans, LA. Retrieved from http://education. ucsc. edu/estell/Stoddart_et_al_2011_ AERA. pdf.

Suriel, R. L. & Atwater, M. M. (2012). From the contribution to the action approach: White teachers' experience influencing the development of multicultural science curricula. *Journal of Research in Science Teaching*, *49*(10), pp. 1271-1295.

Taylor, L. (2006). Wrestling with race: The implications of integrative antiracism education for immigrant ESL youth. *TESOL Quarterly*, *40*(3), 519-544.

Valenzuela, A. (2013). Subtractive schooling, caring relations, and social capital in the schooling of U.S.-Mexican youth. In D. J. Flinders & S. J. Thornton (Eds.), *The Curriculum Studies Reader* (4th ed., pp. 289-300). New York, NY: Routledge.

Wang, S. (2015, April 20). One way street for immigrant integration in schools. *The Indianapolis Star*. Retrieved from http://www.wfyi.org/news/articles/one-way-street-for-immigrant-integration-in-schools.

WFYI. (2015). Lost in translation: Struggle and success as language barriers reshape Indianapolis schools. Retrieved from http://www.wfyi.org/news/articles/lost-in-translation

WIDA Consortium. (2014). *The WIDA Can Do Philosophy*. Board of Regents of the University of Wisconsin System. Retrieved from www.wida.us

WIDA Consortium. (2012). 2012 *Amplification of the English Language Development Standards, Kindergarten–Grade 12*. Board of Regents of the University of Wisconsin System. Retrieved from www.wida.us

WIDA Consortium. (2008). *WIDA® ACCESS for ELLs® Sample Items*. Board of Regents of the University of Wisconsin System. Retrieved from www.wida.us

Wisconsin Center for Education Research. (2012, May). *Focus on Differentiation Part 1.* University of Wisconsin–Madison. Retrieved from www.wida.us

Wisconsin Center for Education Research. (2012, December). *Focus on Differentiation Part 2.* University of Wisconsin–Madison. Retrieved from www.wida.us

Zubrzycki, J. & Colombo, H. (2015, January 8). Feds: Schools must serve English language learners better: IPS, under improvement plan, seeks to change culture of serving non-native speakers. *Chalkbeat Indiana*. Retrieved from http://in.chalkbeat.org/2015/01/08/first-federal-guidance-on-english-learners-in-25-years-stresses-access-communications/#.VU-EWtpVikp