Science for English Language Learners

Introduction

The National Science Teachers Association (NSTA) asserts that all students, including those identified as English language learners (ELL), can and should have every opportunity to learn and succeed in science. Teachers play a critical and central role in this process and should receive necessary support. Likewise, it is important for schools and school systems to devote time and resources to effective professional development for all K–12 teachers of science, including those who teach English language learners (NSTA 2006). Educational policies and practices at every level of the education system should be in concert to provide students with equitable learning opportunities, as set forth in the declarations below.

The linguistic diversity of preK–16 students has been rapidly increasing in every part of the country (TESOL 1997, 2006). More than 5.5 million, or 11%, of public school students are now categorized as English language learners (NCES 2006), and schools, districts, and states are challenged to deliver high-quality instruction to these students (NSF 2006). Coupled with the reduction in the amount of classroom time devoted to school science instruction, particularly at the elementary level (CEP 2008), many of these students receive inadequate instruction and lack access to quality science programs.

It is important that educators who teach science to students identified as English language learners be well versed in science content and pedagogy, and also skilled in pedagogical approaches for integrating language acquisition and science learning. Standards by TESOL (Teachers of English to Speakers of Other Languages) supports this integration and promotes academic language proficiency—the language of school—in core content areas, including science (TESOL 2006). Research has shown that effective teacher preparation and professional development results in positive change in teachers' beliefs and practices in integrating science and literacy for English language learners (Buck et al. 2005; Hart and Lee 2003; Stoddart et al. 2002).

Research on instructional interventions—such as culturally responsive teaching, guided inquiry, and sheltered English instruction—has shown promise for improving achievement outcomes in both science and literacy, as well as narrowing achievement gaps for students identified as English language learners (Amaral, Garrison, and Klentschy 2002; Lee et al. 2005; Lee et al. 2008; Thomas and Collier 2002).

Principles

To ensure all students including English language learners have opportunities to learn and excel in science, NSTA supports the following principles:

- Science lessons, activities, and curriculum for students who are English language learners should be based upon science content and processes outlined in the *National Science Education Standards* (NRC 1996) and state science standards, and anchored to science investigations that promote inquiry (NRC 2000).

- The use of guided inquiry (beginning with a more structured approach and then gradually developing to a more open-ended approach to learning) that builds on students' prior knowledge and science content provides English language learners with opportunities to learn the practice of science (Amaral, Garrison, and Klentschy 2002; Fradd and Lee 1999; Vanosdall et al. 2007; Warren and Rosebery 2008).

- Through participation in effective science instruction that incorporates literacy skills (reading, writing, speaking, listening, viewing, and representing), all students can develop academic literacy in English (Bialystok 2008; Gee 2008; Snow 2008).

- Science instruction should recognize and respect the linguistic and cultural experiences that English language learners bring from their home and community environments, articulate these experiences with science knowledge, and offer sufficient educational resources and funding to support science learning. When this happens, students learn to value their linguistic and cultural identities and develop their identities as science learners (Garcia and Lee 2008; Warren and Rosebery 2008).

NSTA makes the following recommendations to support high-quality science instruction for students identified as English language learners.

Declarations

NSTA recommends that teacher preparation and professional development programs for teachers, regardless of area of certification, focus on science content and pedagogy for English language learners and help teachers

- recognize and build on ELL students' "funds of knowledge" (i.e., knowledge students gain from their family and cultural backgrounds) as a foundation for learning scientific ideas and practices (Moll 1992; Rodriguez and Berryman 2002);

- recognize that students who are learning English or who are from cultural and linguistic backgrounds different from the teachers' background may express what they know in ways that are unfamiliar to their teachers (Hudicourt-Barnes 2003; Warren et al. 2001);

- use instructional strategies that simultaneously promote science learning and English proficiency for English language learners (Amaral, Garrison, and Klentschy 2002; Genesee and Christian 2008; Lee et al. 2005; Thomas and Collier 2002); and

- meet regularly with fellow teachers to share ideas, experiences, tasks, and materials that are effective in teaching science to English language learners (Rosebery and Warren 2008).

High-quality science instruction should meet the learning needs of English language learners. NSTA recommends that science instruction

- provide students with academically rigorous learning opportunities that allow them to explore scientific phenomena and construct scientific understanding and inquiry based on their own linguistic and cultural experiences (Garcia & Lee 2008);

- provide students identified as English language learners with a meaningful learning environment in which to develop fluency in oral and written English as well as in the discourse of science. At the same time, improving English skills should provide the medium for understanding science content (Fathman and Crowther 2006; Lee and Fradd 1998; Rosebery, Warren, and Conant 1992);

- support learning opportunities in different classroom formats (e.g., individual, small-group, and whole-class instruction) so that students learn to work independently as well as collaboratively across varied settings; and

- incorporate effective instructional strategies to enable students who are learning English to access their prior knowledge, learn science content, and communicate science ideas by using multiple modes of representation (gestural, oral, pictorial, graphic, and textual).

- are academically rigorous and develop academic language in the context of learning science;

- incorporate experiences, examples, analogies, and values from diverse linguistic and cultural groups, and consider the knowledge and abilities that all students bring from their home and community cultures (Moll 1992; Garcia and Lee 2008); and

- include embedded assessments that take into account linguistic and cultural influences that affect ELL students' thinking and reasoning, as well as the ways that the students interpret and respond to assessment items (Solano-Flores and Nelson Barber 2001).

NSTA supports educational policies that meet the needs of ELL students learning science, including those that

- encourage states, districts, and schools to allocate resources for English language learners to learn rigorous science content and make adequate academic growth across successive years to reduce and close science achievement gaps;

- provide adequate time for science instruction for students identified as English language learners and reject the perceived notion that literacy and numeracy must be developed prior to science (Lee and Luykx 2005);

- allow or encourage the use of students' home language as an instructional support to promote science learning, even within an "English-only" policy (Goldenberg 2008; Garcia and Lee 2008); and

- make accommodations for English language learners to demonstrate their science knowledge separate from English proficiency or general literacy, such as conducting assessments and reading instructions in ELL students' home language in addition to English, providing separate testing environments and allowing more testing time (Abedi 2004; Solano-Flores 2008).

NSTA supports a research agenda that promotes science learning for students identified as English language learners. NSTA recommends that future research

- examine both the benefits and demands involved in learning science through inquiry by identifying how the essential aspects of inquiry-based teaching and learning relate to the linguistic and cultural experiences of English language learners;
- address student outcomes, including quantitative achievement data and other types of outcomes, in both science and literacy;
- examine how teachers' theories about students' knowledge base and instructional practices evolve as teachers reflect on ways to integrate these multiple domains to promote science learning and literacy development; and
- give high priority to examining the science-related "funds of knowledge" existing in diverse contexts and communities, such as how parents and community members can serve as valuable resources for school-based science learning, or the ability of community-based projects to help students recognize the relevance of science in everyday life.

—Adopted by the NSTA Board of Directors, December 2009

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