Epistemological Linguistics

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Abstract

Numerous researchers are coming to appreciate the linguistic and interactional nature of content learning. At the same time, language-centered educational standards are being implemented nationwide, and the federally protected but educationally struggling English Learner population is rapidly expanding (Migration Policy Institute, 2013). In response to these evolving circumstances, a new subdiscipline known as *Epistemological Linguistics* is emerging in which researchers are exploring the role of language in content learning. This field will also offer practitioners and policy makers recommendations based on up-to-date theory and ample, sound empirical evidence surrounding disciplinary learning. Epistemological linguistics is also taking advantage of the rapidly growing capacity of computers to facilitate and enhance, as well as collect and analyze data on, students' learning of language and content.

A great deal of resources will be required to help teachers and administrators understand that content and language learning are both best supported by helping students engage with each other in rich discourse about subject matter, not by attempting to impart knowledge to them. Research is critically needed to develop widely useful pre-service and professional development models (including for administrators) that address the needs of English Learners. Epistemological linguists will help provide policy makers, schools, and teachers with models for how best to support English Learners' content learning. Findings in this subdiscipline will influence instructional outcomes in ways that improve life chances for English learners, and indeed all students.

BACKGROUND AND CONTEXT

Recent changes in US educational policy as well as demographic shifts in the linguistic composition of the student population have created a Pasteur's Quadrant—a research environment in which addressing a significant social problem space inspires a quest for basic understanding of linguistic, cognitive, and social structures and processes involved in student learning (Stokes, 1997). Because a main goal of schooling is the development of epistemological practices (e.g., gaining knowledge as scientists, mathematicians, philosophers, humanists, historians, and artists) and many of those practices are

reflected through language, we call this emerging field epistemological linguistics.

One might think of developing epistemological practices as a rather ambitious goal that departs radically from the current focus on acquisition of basic knowledge and skills ("the three R's—reading, writing, and arithmetic" in the regular curriculum, plus a focus on grammar and vocabulary in English-as-a-Second-Language classes). However, the sea change in the nation toward the widespread adoption of college- and career-ready standards, generally referred to as the *Common Core State Standards*, does indeed make college-level rigor a goal for all students.[1]

These influential new standards reflect the linguistic practices that students must master in order to fully engage in critical practices of the content disciplines (Council of Chief State Schools Officers, 2012; Hakuta, Santos, & Fang, 2013; Moschkovich, 2012; Stage, Asturias, Cheuk, Daro, & Hampton, 2013; Valdés, Bunch, Snow, & Lee, 2005). Disciplinary knowledge cannot truly be separated from the ability to use the linguistic forms and registers that make up the on-the-ground practices of that discipline, such as explaining models, making and supporting claims, understanding others' arguments, and validating ideas through peer review. Academic disciplines are all heavily linguistic in nature. Much of the knowledge of the disciplines consists of arguments and explanations, and all the disciplines have their own conventions for what counts as evidence, argument, and explanation.

Existing research focused on the relationship between content and language is limited, and exists primarily under the broader umbrella of Educational Linguistics. A deep understanding of how language practices develop into expertise would recruit from virtually all aspects of linguistic analysis, but particularly sociolinguistics, cognitive linguistics, discourse analysis, semantics, and pragmatics. We are proposing here to delineate this growing area of interest as Epistemological Linguistics. The privileging of the language demands within the content areas in the new standards has helped spur Epistemological Linguistics to begin creating empirically based models and theories of the relationship between language and disciplinary knowledge. This field's findings will inform classroom instruction as well as education systems and policy.

The growth in the user end of the Pasteur's Quadrant, focusing on the role of language in content learning, is also driven by the rapid growth of the linguistic minority population in the United States. Many of these students are immigrants or children of immigrants, and their status as learners of English

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1. As of this writing, 46 states have adopted the Common Core State Standards in English Language Arts, Literacy and Mathematics, and a large number of states have adopted or are in the process of adopting the Next Generation Science Standards. Activity is also under way to create a common set of college- and career-ready set of standards in social studies.

as a second language makes them a focus for federal protections (under Title VI of the Civil Rights Act and the Equal Educational Opportunities Act) as well as additional federal funding (under Title III of the Elementary and Secondary Education Act, currently known as *No Child Left Behind*). English Learners are also identified as a subgroup of students whose achievement on content area tests in language arts and math must be reported separately to show improvement for accountability purposes under a major federal assistance program (Title I of No Child Left Behind), and whose low performance has been a large focus for federal, state, and local officials (US Department of Education, 2012).[2]

Given the heavily linguistic nature of the new performance standards as well as the inherent challenges that these standards impose on students who are developmentally in the process of acquiring a second language, educators are now keen on focusing their instructional improvement efforts that help advance the goals of both second language development as well as content knowledge development. How to conceptualize and support this effort is an engineering problem that requires the support of good practical theory that focuses the task.

The world of professionals who concern themselves with student learning in both language and content can be seen along the following simplified spectrum (roughly in order from the student out into the larger system):

- Teachers who see their role as instructional delivery and the facilitation of learning. They might ask: I know that it is important for me to give students time to engage in discussions with each other about their work, and that the mathematics standards call for students to be able to "understand the reasoning of others." When I listen in on their discussions, what are the characteristics of language that I should be paying attention to, and how should I use this information?
- School principals who see their role as facilitating a school-wide culture of learning, often making decisions about how to allocate instructional time and resources such as funds for professional learning. They might ask: during the time that I allocate for my teachers to engage with each other as professional learning communities, our teachers have decided to focus on samples of student writing. The new standards call for students to "write arguments from evidence and reason." I need to know how to help these teachers provide the right kinds of feedback to students.

2. English Learners have reached a critical mass nationally. According to the Migration Policy Institute (2013), in 2007–2008, there were over 5.3 million English Learners in K-12, representing approximately 11% of the total student population. While English Learners are heavily concentrated in some states and cities (e.g., California, Nevada, New York City, Chicago), one of the most striking recent trends has been the growth of EL populations in even rural parts of the country, most notably the South (Capps et al., 2005).

- School district leaders who often make decisions about curriculum and textbook adoption, coordinate district-wide professional development opportunities for teachers and principals, make personnel decisions, and answer to the school board. They might ask: our district requires all students designated as an English Learners to have at least one period dedicated to English Language Development. This is required of my district through a memorandum of understanding with the federal Office for Civil Rights to ensure that my district pay attention to the specific needs of these students. What guidance should I give to our principals and teachers on the curriculum during this time?
- Local school board members who are elected or appointed by elected officials and therefore are accountable to the public, and who hire and fire the superintendent. They might ask: my constituents are saying that too many English Learners are not learning English fast enough, that they are trapped in the stigma of low-level classes by this label, and that the schools are not doing enough to move them out of these programs. How do I know when a program is helping or hurting the students?
- State education agency officials who coordinate statewide implementation of content and English Language Proficiency standards. They might ask: there are two sets of standards that I must coordinate: the new Common Core State Standards and the new English Language Proficiency standards. We are trying to change two things at the same time, and I am afraid that the implementation can become confusing. What should I be communicating to school districts about the relationship between these two sets of standards?
- State education board members who are either elected or appointed, who make decisions about standards and assessment programs. They might ask: we as a state board have adopted the Next Generation Science Standards, and the science teachers like the new standards but are saying that they need better materials and professional development support to really give ELs access to standards-aligned instruction, especially around how texts are used during instruction. How can I get the publishers and professional development suppliers who work with the state to be responsive to these demands?
- Federal education officials who manage education programs (especially Title I and Title III of ESEA) and the flexibility program from NCLB provisions. They might ask: the US Department of Education is asking states to reform their teacher evaluation system, and in doing so to use student test scores as part of the system. What special considerations do I need to give for the teachers who teach significant numbers of English Learners, whose performance on these tests may not be valid if their English Language Proficiency is low?

- Federal civil rights officials who monitor and enforce the requirements of Title VI of the Civil Rights Act (as interpreted in Lau v. Nichols and the Equal Educational Opportunities Act) that prohibits discrimination on the basis of national origin and English language proficiency. They might ask: my job is to ensure protection of the legal rights of students to English language assistance programs. The districts are saying that the requirement for dedicated time for English Language Development services is too restrictive, but that is the only way that I can ensure that the students are receiving targeted services. I understand that the new standards require the content teachers to support language development, but I need court-worthy evidence that this is effective.

These examples portray a complex system united by a need to better understand the developmental relationship between academic knowledge and how it is taught, learned, expressed, and assessed. Federal laws have always paid attention to the duality of the language and academic content need of students, but have had difficulty expressing it in policy and practice. The recently adopted standards create a new configuration of how language and content are put together. The role of theory is to provide knowledge and insight about the shift to the new standards for educators, create tools for supporting implementation within their sphere of work, and provide ways to evaluate the effectiveness of different approaches.

The Castañeda standards, named after a 1981 US Fifth Circuit Court ruling in interpreting the Equal Educational Opportunities Act (Castañeda v. Pickard), are useful in this context to bring together theory, policy, and practice. In that ruling, the judge helped define an "appropriate action" by an educational agency serving English Learners as meeting three standards: (i) the approach is based on sound educational theory, (ii) the approach is implemented adequately with sufficient resources, and (iii) after a period of time, the approach is shown to be effective in removing the barriers of English Learner status on key outcomes. An implicit fourth standard concerns reform, that is, that in the absence of effectiveness, the implementation or approach is to be modified. These principles have become *de facto* policy for the Office for Civil Rights in the Department of Education in investigating complaints about educational programs for English Learners.

Below we elaborate on the foundations of study in Epistemological Linguistics and explain how they have led to the current state of inquiry and understanding. We also provide examples of specific research questions that are likely or useful to arise. We base these expectations on current trends in policy, demographics, and theories of language and learning, as well as on contact with diverse educators and learners, and leading researchers and policy makers.

EDUCATIONAL LINGUISTICS

Epistemological Linguistics carves out a space from Educational Linguistics and the broader field of Applied Linguistics, which look at how people learn and use language but generally *separately from how they learn content knowledge or how language is used specific to domains of knowledge*. Applied Linguistics (typically under the subfield of Second Language Acquisition) tends to focus on adult learners, whereas Epistemological Linguistics is centered on K-12 students.

Work by Lantolf (2000), Mercer (1995), and Walqui and van Lier (2010) demonstrates the influence on Educational Linguistics of a growing body of social science research which views learning not as the acquisition of knowledge structures (from teacher to student) but as the socioculturally situated coconstruction of knowledge by learners (Rogoff, 2003; Vygotsky, 1978). A trend toward socially focused linguistic research can also be seen in the emergence of Interactional Linguistics (Halliday & Matthiessen, 2004; Ochs, Schegloff, & Thompson, 1996; Selting & Couper-Kuhlen, 2001) and Sociolinguistics (Alim, 2006; Geenberg, 2012; Mendoza-Denton, 2008). Research in Epistemological Linguistics will continue the trend of addressing sociocultural issues alongside more purely "cognitive" ones such as learners' information understanding and retrieval, metacognition (or their thinking about their own learning), and prior knowledge (see, e.g., Bransford, Brown, & Cocking, 2000). This new field will help build a theory of (content *and* language) learning that encompasses the sociocultural as well as cognitive aspects of learning.

Future researchers will determine how content knowledge is structured with regard to higher levels of language, going even beyond vocabulary structure, grammatical form, and semantic relations. Given current trends, research will likely arise that looks at how various factors in the classroom, such as interactivity (DeHaan, Reed, & Kuwada, 2010; Tavakoli & Foster, 2011) and modality (oral vs written) (Anstrom *et al.*, 2010; Leow, 1995; Sheen, 2010) of tasks affect K-12 students' ability to engage in the language practices associated with the content disciplines (i.e., arguing from evidence, critiquing reasoning). Student motivation (Dörnyei & Ushioda, 2009; Norton, 2000) and attention (Gass & Mackey, 2006; Swain, 2005), and how language interacts with these factors, will also likely be key topics of interest.

Literacy researchers will be able to determine which characteristics of texts have the most important consequences for comprehension, and whether this varies by epistemological domain. In the area of Mathematics, we will learn more about what features of mathematical word problems cause students the most difficulty, and how word problems can be improved to focus the

difficulty on target concept(s) (Moschkovich, 2012). In science, researchers are beginning to break down the linguistic demands of scientific practices such as modeling, developing explanations, and evaluating scientific information into their constituent productive and receptive language functions, and describing the modalities and registers of science classrooms (Lee, Quinn, & Valdés, 2013; Osborne, 2013; Schleppegrell & Palinscar, 2013).

SOCIOLINGUISTICS OF LEARNING

Our understanding of the social aspects of language use has grown rapidly over the last several decades, since Labov (1966) influentially demonstrated that language use by New York City residents was patterned by social class. Sociolinguists have discussed how speakers' language use reflects sociolinguistic categories such as race (Fought, 1999; Rickford, 1999), class (Haeri, 1997; Trudgill, 1974), age (Cukor-Avila, 2000; Greene, 2010), gender (Eckert, 1989; Matsumoto, 2004), and sexuality (Cameron & Kulick, 2003; Zimman, 2013); linguistic audiences and settings (Podesva, 2007); and social identities and styles (Bucholtz, 1999; Eckert, 2000). Lippi-Green (1997) also brought attention to how standard American English is socially valued above most nonstandard dialects in ways that reflect and perpetuate racial and other social prejudices. Epistemological linguists may ask, what aspects of the language of the content classroom are most important for students to master, in order to actually succeed in various contexts? How does the income level or race of a student's family correlate with students' learning of the discipline-specific uses of language? How are students affected by culturally insensitive content learning materials?

Given the crucial nature of the link between schools and English Learners' homes and communities (US Dept. of Ed., 2012; Williams, Hakuta, & Haertel, 2007), research needs to examine what types of attitudes content teachers and administrators have toward English Learners, and how these attitudes affect English Learners performance in content classrooms. What are the best ways that a school district can engage with English Learners' home communities, in order to foster student learning of content knowledge and language development?

Little research has been done in the area of how English Learners' learning needs are related to those of speakers of nonstandard English dialects, such as African American Vernacular English (Mufwene, Rickford, Bailey, & Baugh, 1998) or Appalachian English (Hazen & Fluharty, 2004). Given the large number of nonstandard dialect speakers and their lack of federal protection, it would be beneficial to draw comparisons between the needs of English Learners and those of dialect speakers.

AUTOMATED LANGUAGE AND EDUCATION

Interest in Epistemological Linguistics is also arising in part due to new capacities of computers to address new kinds of questions about what language in the classroom looks like, and how it should look in order to best foster learning of all types. Since the 1970s and 1980s, the creation of massive, annotated corpora of language data [e.g., Penn TreeBank (Marcus, Marcinkiewicz, & Santorini, 1993) and PropBank (Palmer, Gildea, & Kingsbury, 2005)] and the expanding popularity of high-performing computers, combined with computational linguists' increasingly advanced use of statistical modeling, have contributed to an explosive growth in the sophistication of automated Natural (meaning human and not computer) Language Processing (NLP) technology (Jurafsky & Martin, 2008). These systems or models can rapidly process large amounts of linguistic data, including both text and speech. Some of the most up-to-date and widely used automated language processing technologies are ETS' e-rater essay scoring engine (Attali & Burstein, 2006), Google Translate (www.translate.google.com), Apple's Siri application (www.apple.com/ios/siri), and the GALE speech recognition project at SRI (http://www.speech.sri.com/projects/GALE/). Within the foreseeable future, teachers (if given the time and resources for training and implementation) may be able to record their entire classrooms and compare those classroom recordings online to annotated examples from other classrooms of the same grade level and subject area, in terms of such factors as syntactic complexity, or even the level of student engagement in disciplinary practices, or the constructiveness of peer interactions. Teachers will be able to quickly determine how their classroom discussion can be improved in order to better support student learning. Aiding our understanding of learning and language, there will likely be a seamless transition between auditory and digitized representations of speech via automatic speech recognition and production, and a snowballing of linguistic types of web content due to crowdsourcing. Technology will allow us to make and test new and more sophisticated types of claims.

Researchers have had particular difficulty but are beginning to succeed in automatically processing speech from language learners (Ding, Hoffman, & Jokisch, 2011; Neri, Cucchiarini, & Strik, 2004; Truong, Neri, Cucchiarini, & Strik, 2004) and children (Lu, 2009; Sagae, Lavie, & MacWhinny, 2005; Sahakian & Snyder, 2012). However, with abundant speech data to train the programs on, such as those that will become increasingly available in education, NLP technologies will quickly become competent with EL and child speech.

Researchers will also increasingly be able to develop computer technologies to help schools identify which students are English Learners, distinguish

English Learners from students with disabilities (or students who belong to both categories), assess language and content learning effectively, and allow English Learners to exit from programs when they are ready. These tools will help schools, districts, and states support English Learners to thrive rather than fall through the cracks.

Another key emerging area of interest is the use of games and other adaptive learning technologies to further learning (Kapp, 2012; Lee & Hammer, 2011; Muntean, 2011). Games and other computer learning technologies allow the learning experience to be tailored to students' own progress from one second to the next. This field is especially promising for English Learners because computers can help schools respond more effectively to the highly diverse, individualized, and pressing needs of such students (US Dept. of Ed., 2013). Students can have fun playing a game but at the same time develop content and English expertise and have learning supports removed in a way that supports their autonomy. Games also have the potential to be used to get and keep learners interacting meaningfully with one another, which socioculturally minded researchers see as the cornerstone of learning (Rogoff, 2003; Vygostky, 1978).

All of the technologies used in learning (e.g., games, online activities, online courses) will produce immense collections of (potentially quite sensitive) language data and associated meta-data that researchers must determine how to structure efficiently, store and manage with the necessary extreme discretion, and manipulate and analyze effectively. Research that provides models for how schools can report longitudinal performance of English Learners is especially needed (Hopkins, Thompson, Linquanti, Hakuta, & August, 2013; Saunders & Marcelletti, 2012).

CONCLUSION

A new subdiscipline of Linguistics known as *Epistemological Linguistics* is emerging, which explores the role of language in content learning. Education researchers are beginning to realize that content learning has key linguistic and interactional aspects. At the same time, the nation is widely adopting and implementing language-centered educational standards. Furthermore, the number of English Learners in the United States is growing with great speed (Migration Policy Institute, 2013). This population faces a significant achievement gap, but is federally protected, further spurring research on the role of language in K-12 content learning. Epistemological Linguistics holds the promise of producing evidence- and theory-based recommendations for practitioners and policy. Epistemological Linguistics will also take advantage of the rapidly growing capacity of computers to facilitate and enhance, as well as collect and analyze data on, students' learning of language and content.

An immense level of resources will be required to help teachers and administrators understand the interdependence of content and language learning, and give them models for how to best support students to engage in rich content-based discussions, rather than simply imparting knowledge to them. Research is also critically needed to develop widely useful EL-focused preservice and professional development models (including for administrators). Findings in this subdiscipline will influence instructional outcomes in ways that improve life chances for English Learners, and indeed all students.

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