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Improving in-service teachers' effectiveness: K-12 academic literacy for the linguistically diverse

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Abstract

This study investigates how in-service teachers' learning of a functional linguistic approach for instructional design contributes to linguistic sensitivity, knowledge acquisition, skill development, and classroom practice for their students' development in content/discipline specific literacy. Twenty-three K-12 teachers with teaching experience ranging from 1 to 12 years, from one urban and three rural school districts, took part in this study. The mixed-method approach includes interviews, baseline and post intervention measures related to instructional planning, and classroom practice observations. The professional development intervention resulted in statistically significant changes in means on all measures. Thematic analysis of interview data showed an increase in the teachers' knowledge of linguistic sensitivity for linguistically and culturally responsive instruction. Implications for the findings include a need for increased linguistic sensitivity among teachers through teacher preparation programs at colleges, or in professional development for advanced teachers.

Keywords: Teacher professional development; Functional linguistic approach; Urban; Rural

This paper examines the impact on classroom teachers of an in-service professional development program designed to help K-12 teachers in various school content areas to incorporate an academic language/literacy component in their instruction and to improve their teaching effectiveness in linguistically diverse classrooms. According to the most current figure from the National Center for Education Statistics (http://nces.ed.gov/fastfacts/display.asp?id=96), the percentage of public school students in the United States who were English Language Learners (ELLs) was higher in the school year 2011–12 (9.1 %, or an estimated 4.4 million students) than it was in 2002–03 (8.7 %, or an estimated 4.1 million students). Classroom teachers often feel professionally inadequate to do a good job with the knowledge and skills they received from a typical teacher preparation program that lacks attention to linguistically diverse learners (Balderrama 2001; Darling-Hammond *et al.* 2002; Gandara *et al.* 2005). While available literature points to a need to prepare all teachers for culturally and linguistically diverse students (Garcia *et al.* 2009), there exists a gap between the needs of classroom teachers to work with ELLs and the lack of teachers prepared to work with this student population, which has led to a growth of interest in teachers' professional development related to ELLs. Existing research efforts have been made to examine the factors contributing to professional development of classroom teachers in culturally and linguistically diverse settings, but most studies (see Garcia *et al.* 2009) focus more on cultural

responsiveness with little attention to the linguistic aspect for teacher development (see Aguirre-Munoz *et al.* 2008). This study examines a teacher development program that utilizes a functional linguistic approach (Halliday 1976; Mohan 1986; Schleppegrell 2004, 2010) to equip the teachers with knowledge and skills for students' academic language and literacy development and shows the impact of such a program as evidenced by the change in not only teachers' beliefs, perceptions, and knowledge, but also their instructional practice in the reality of their everyday teaching.

Background

In this paper, we take the position to view literacy as a part of, and inseparable from, language development. Thus, the two words are often used interchangeably.

Academic literacy and teacher development

Academic literacy, which is discipline specific, is not a new concept in the field of literacy education. From a socio-cultural perspective, the development of academic literacy takes place in specific academic content areas (Fang 2014; Gee 2007; Gibbons 2009; Schleppegrell 2004; Zwiers 2008). Thus, instructional practice that separates literacy development from academic content learning becomes problematic. Existing research has shown that adequate development of academic language and literacy skills is crucial for students' school success (Fang 2012; Schleppegrell 2004; Schleppegrell and O'Hallaron 2011; Zwiers, 2008). Many scholars, noticing that achievement disparities between ELLs and non-ELLs stem from the lack of instructional focus on academic language, argue for the need to make the linguistic structures of academic language explicit to ELLs (*e.g.* August and Shanahan 2006; Fang 2012, 2014; Gibbons 2002, 2003; Wong and Snow 2000). From the perspective of teacher development, a practical question is how to guide teachers to systematically incorporate students' academic language growth while teaching the specific academic content such as math, science, and social studies.

Related to ELL education is the issue of systematic integration of language and content (Mohan 1986). Linguistic and cultural aspects make an obvious impact on a student's language development and conceptual learning (de Jong and Harper 2005; Harper and de Jong 2004, 2009). Available studies have provided a strong argument for culturally responsive approaches to instruction (Cartledge and Kourea 2008; Garcia and Ortiz 2006), but a culturally responsive agenda with no emphasis on linguistically sensitive pedagogy will be insufficient in addressing the issue of culturally diverse students struggling in the use of mainstream linguistic resources for academic success (Schleppegrell 2004). Thus, a culturally responsive pedagogy with an emphasis on the linguistic aspect, specifically academic language, for successful schooling for all children is needed. Such an approach requires theory-informed and research-based instruction, and assessment strategies that make the connections between academic content and content specific English explicit for the students. While studies from the socio-cultural perspectives (de Jong and Harper 2005; Gee 2007; Halliday 1976; Huang 2004; Mohan 1986; Schleppegrell and de Oliveira 2006) convincingly argue for the effectiveness of systematic integration of language and content in instruction for diverse students, the literature is limited to successful methods for developing teachers to implement this instructional integration.

Among those addressing in-service teacher development for content specific literacy education, most of the studies are limited to teachers' beliefs, perceptions, and knowledge development (Glaeser *et al.* 2012; Pawan 2008; Pytash 2013). There are some studies that connect teacher perceptions to their development and professional practices (Aguirre-Munoz *et al.* 2008; Huang 2004; Hart and Okhee 2003), such as Aguirre *et al.*'s study that provided clear evidence demonstrating the effectiveness of a systemic functional linguistic approach to teacher development for attention to academic language/literacy in teachers' instructional practice, but the findings are limited to teacher development in the area of middle school language arts.

Language in context: an SFL approach to academic literacy development
A Systemic Functional Linguistic (SFL) approach examines how the context in which the discourse takes place impacts the language system, or the choices that have evolved to serve our needs (Halliday 1976, 1994). It shows, for example, how the language typical of the oral discourse among a group of friends is different from a formal oral presentation; how the language of an oral presentation is different from a written report or argument; or how the language of science is different from the language of literature. The situational context influences the kinds of choices we make from the language system. Context of situation is described through three variables that influence the use of language: the topic or content being talked about and the social activity being pursued; the relationships between the people involved; and the medium and role of language in the situation. Thus, in contrast to traditional literacy instruction, which typically sequences instruction from the smallest unit of language such as phonics, a SFL approach would consider context as the starting point, taking into account the three variables in context of a situation when making a decision on the linguistic resources that should be introduced and explored for development of literacy skills.

Content area literacy education has long been influenced by schema theory (Bartlett 1932). While the schema theory highlights the importance of the content knowledge and background information organized cognitively in content specific literacy skills development, it is SFL that has provided an analytical tool to make the connections explicit between form and meaning, and between language and functions.

In the past decade, SFL, widely used as a theoretical foundation for language and literacy education in international settings, has gradually made its way into the American educational field, partially due to the great effort made by American scholars in the field of ESL education. Zwiers (2008) and Schleppegrell's (2004) work on academic language development in school settings have drawn attention to linguistic resources that we use to construct meaning in contextualized ways. The essence of the recent studies in literacy education from the SFL perspective is an emphasis on integration of language/literacy and content (*e.g.* Huang and Mohan 2008; Fang 2012; Schleppegrell 1998, 2001, 2003, 2004).

Our approach to teacher development with a focus on students' academic language/literacy skills in content specific context is influenced by SFL that views learning as a linguistic process. This linguistic view of learning results in a unified view of learning language, learning through language, and learning about language (Halliday 2007). In this view, the child learning language for the first time is engaged in a process of

language socialization (Ochs 1988; Schieffelin and Oachs 1986); the child is seen to be learning language and simultaneously be learning through language, that is, learning about the world. Extending this view to ELL students learning science in a school setting, we see the learning of the language for science as related to the learning of science content, in a process of second language socialization.

A major premise of SFL is that language is a resource for meaning. "The focus is on how people use language to make meanings with each other as they carry out the activities of their social lives. They do this through their selections from the sets of choices that are available in the language systems." (Christie and Unsworth 2000, p. 3). The linguistic choices go beyond words. Meaning construction is realized through the use of a combination of linguistic resources in the forms of words, sentence, and discourse.

Among the efforts to make connections between language and content from Halliday's functional view are register theory (Halliday *et al.* 1964), genre analysis (Martin 1992), and the Knowledge Framework (Mohan 1986). For our professional development project, we have chosen the Framework of Knowledge Structures, or more frequently referred to as Mohan's Knowledge Framework (KF), to guide teachers' instructional planning since it has been successfully used to help classroom teachers organize instruction that leads to a wide a range of form-meaning connections (Huang 2000, Huang and Mohan 2008; Early 1991; Tang 2001). Also, while emphasizing on systematic integration of language and content, it addresses the psychological paradigm of Bloom's taxonomy (Anderson *et al.* 2000) that all of the teachers were familiar with from their previous teacher education programs. The Knowledge Framework, which takes an SFL approach as a basis to analyze language related activities, serves both as a theoretical base for systematic integration of language and content and as a practical guide to academic task analysis, instructional design, and assessment implementation. The KF, approaching analysis of content topics from the perspective of "knowledge structures" (Abelson and Black 1986, p.1), provides a vehicle to look into the relations between the language used and the knowledge structured as a result. Used as a guide for instructional planning, it helps a teacher analyze a content topic into six core Knowledge Structures (KSs): classification, description, principles, sequence, evaluation, and choice. Each KS has its own linguistic features and involves particular thinking processes. For example, when one engages in an activity of a certain KS in a certain context (like categorizing different types of trees) particular linguistic features associated with that KS are used: vocabulary in relation to types of trees (deciduous, coniferous), syntactic structures signaling taxonomic or part-whole relations (Y is a type of …), and discourse devices that connect sentences together to make the whole text—oral or written—coherent in expressing the content meaning of how trees are categorized. Additionally, organizing structures relevant to the thinking processes associated with a content topic are likely to be used (*e.g.*, classifying, categorizing, defining, etc.). Thus, the KF plays the role of linkage between specific aspects of content and specific language features at word, sentence, and discourse levels while at the same time provides opportunities for various levels of cognitive engagement. An example of instructional design based on the KF developed by a participating teacher is presented in Table 5 for a unit on Genetic Diseases. We will elaborate on this example in the methodology section.

Present study

Our literature review, revealing research gaps, suggests that 1) there is a need to develop teachers' linguistic sensitivity (Commins and Miramontes 2005; Jiménez and Rose 2010; Sleeter 2008) so as to provide culturally responsive and linguistically sensitive instruction to facilitate students' academic success; 2) studies that recognize the importance of linguistic sensitivity in teacher development are extremely limited in their scope to embrace various school content areas, and to connect professional development activities to the improvement of teachers' instructional practice. This study, with the intention to fill in some of the research gaps, thus examines how a functional approach helps K-12 teachers in various content areas develop linguistic sensitivity so as to provide linguistically responsive instruction in the reality of their teaching. For the purposes of this paper, we have chosen to use the acronym ELL as we believe that it is inclusive of native English speakers who continue to learn English in different contexts and that all students benefit from teachers who are better prepared. The specific question that guided this research effort is:

> How does professional development (PD) with a linguistic focus from a functional perspective make (or not make) an impact on teachers' knowledge acquisition, skill development, and classroom practice for students' content specific literacy?

Methods

This study is pragmatic in nature as seen from the various fields discussed in the literature review and thus a mixed-methods design was selected (Johnson *et al.* 2007; Creswell 2014). Data was collected through quantitative measures such as closed-question surveys and numeric rubrics related to PD assignments followed by an interview with open-ended questions. The research design is an embedded mixed methods design—QUAN (qual)—because we wanted to incorporate the perspective of the teachers through interviews. The qualitative and quantitative data together minimize "the limitations of both approaches" (Creswell 2014, p. 218) and provides a deeper understanding of the change in the instructional practice. Data was interpreted by examining evidence from all the sources to build a "coherent justification" for themes (Creswell 2014). The triangulation of data and the length of time spent with the teachers (six months) strengthen the validity of the findings.

Setting

The professional development project, with the support from a Title II grant, was initiated by a conversation between the university's teacher preparation faculty and the school districts whose teachers are experiencing challenges working with culturally and linguistically diverse learners in the general education settings. The participating districts have at least 28 % of students designated as English Language Learners (ELL) and 60 % as coming from a Spanish speaking background but not necessarily designated as ELLs; these percentages are higher than the national average. The Hispanic students may speak fluent everyday English but struggle with academic language. Most of the teachers, facing a class with diverse learners as described, had never been formally trained to teach ELLs. At the same time, the state was adopting a new set of English language standards based on the WIDA Language Proficiency Standards (WIDA Consortium 2012), which are heavily influenced by SFL (Halliday 1976, 1994) and are content and grade specific.

The PD program, designed in partnership with the school districts, consisted of four 3 credit hour courses, for a total of 12 credit hours of instruction, with a mandatory on-site coaching and mentoring component. The first two courses focused on instructional and assessment methods that emphasized a socio-cultural perspective for second language development and have their theoretical foundation supported by SFL. The third course, coupled with a fourth course on the special needs of linguistically diverse learners, offered in the second semester, formally introduced the teachers to SFL for language education focusing on the functions of language in linguistic resources for meaning through application. Specifically, teachers were introduced to the concept of the KF and the six basic KSs. Then, using the KF, teachers designed instructional units that analyzed academic tasks for their functions and the associated linguistic features at the levels of lexicon (vocabulary), syntax (sentence), and discourse, so as to provide linguistically responsive instruction. An example of the instructional design based on the KF developed by a participating teacher is presented in Table 5 for a unit on Genetic Diseases. Teachers in this study were trained using the KF that demands analysis of academic tasks for their functions—what is being discussed (field), who/how it is being discussed (tenor), and the medium through which it is discussed (mode)—and the associated linguistic features at the levels of lexicon, syntax, and discourse. For example, in the Genetic Diseases example (Table 5), the field is biological science; the tenor will be informal when small groups of peers discuss the "principles" of genetic science; and, the tenor will be more formal when the "choice" around genetics is presented. The mode for conveying understanding of the "principles" is oral while there are at least two modes for the presentation: written messages on slides, and oral messages of support for those slides. We pushed the teachers to never settle for non-native English speakers simply drawing a picture for the determination of understanding since success in schooling depends greatly upon linguistic means.

At the successful conclusion of the program, participating teachers would be awarded a Culturally and Linguistically Diverse (CLD) specialist certificate, and the courses could lead to a Master's degree in CLD Education.

Participants

In this paper, all participating teachers are referred to as teachers; all K-12 learners of those teachers are referred as students. Professors are those delivering the courses and mentoring the teachers in the classrooms. Twenty three K-12 teachers, with teaching experience ranging 1–12 years, from one urban and three rural school districts took part in this study. There were 13 elementary level (K-6) teachers and 10 secondary level (7–12) teachers. The content areas taught by these teachers included: math, science, social studies, language arts, visual arts, computing/technology, family and consumer sciences, theatre/drama, health, music, special education (elementary, math, and literacy), world languages, pull-out ESL, and other subjects.

The research team included three university professors from a college of education and a doctoral candidate from the statistics department. The three research professors' areas of focus are language, content literacy, and linguistically diverse education. We all had taught in public schools within Canada or the United States prior to entering professorships.

Data collection and analysis

A comparative analysis of data collected at different stages of the program looks into the development of teachers' linguistic awareness and sensitivity, and their ability to integrate subject matter instruction with language development activities at the levels of both instructional planning and instructional practice as a result of such a development. Examining data from teachers teaching different content areas at different grade levels could be challenging. However, the purpose of the study was to examine the change of teachers and their teaching practice in their own content areas. Though the curriculum content to be taught is different, the need for teachers to make the connections explicit for students, between meaning construction and language use, is the same. Thus, all the analytical tools for data analysis were designed to be inclusive of content and grade diversity. During data analysis focusing on teachers' attention to content specific language/literacy skills, the researchers, with diverse experience and expertise in content specific literacy, made the decision on teachers' sensitivity for and ability to incorporate appropriate language requirements.

Four different sources of data provided information for the study. A visual model of the embedded mixed method design (Creswell 2014) is provided in Fig. 1 to show when data was collected in relation to the professional development courses.
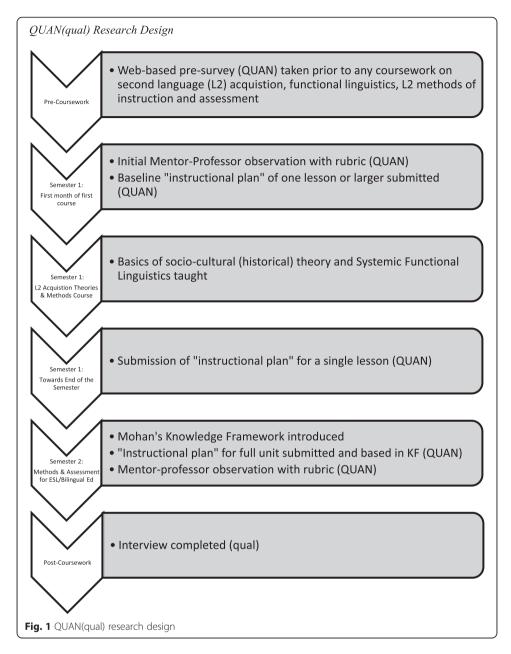
Pre-survey and interview

To examine teachers' change in beliefs, perceptions, and knowledge, data in the form of survey and interview were collected. When teachers signed up for the development program they were given a pre-survey to determine demographics, teaching assignments, and perceptions on their pedagogical practices in relation to working with CLD students. This survey information was collected and analyzed with Qualtrics, a web-based survey tool. At the end of the first two courses, on a voluntary basis, 20 teachers, given a copy of their pre-survey were interviewed using a protocol that asked them to look back at their responses on the pre-survey and discuss their perceptions after the initial two classes.

All audio taped interviews were transcribed as data. Thematically organized units in interview responses were analyzed using a constant comparative method (Strauss and Corbin 1998), adjusting categories and subcategories as necessary with the examination of each piece of additional data. In the initial phase, the researchers employed open coding that entertained all analytic possibilities to account for the data, and a coding that linked categories and subcategories of patterns that emerged from the data (Strauss and Corbin 1998). If a teacher repeated a theme that was disrupted by a different theme when responding to a question, the utterances were counted as separate units. When the data fit more than one category, the dominant function of the utterance was determined and then coded accordingly. In the next phase, a complete count of all utterances within each category was used to determine the frequency of categories and subcategories, and compared to the qualitative data to better understand the statistical analysis of the quantitative data.

Instructional plans

Data in the form of lesson plans provide evidence of change in teachers' instructional planning. When teachers entered the program they were asked to submit as baseline data a lesson plan they typically used. In the first course, the teachers were required, based on their current school curriculum, to design two lesson plans for a content area

QUAN(qual) Research Design

Pre-Coursework
- Web-based pre-survey (QUAN) taken prior to any coursework on second language (L2) acquistion, functional linguistics, L2 methods of instruction and assessment

Semester 1:
First month of first course
- Initial Mentor-Professor observation with rubric (QUAN)
- Baseline "instructional plan" of one lesson or larger submitted (QUAN)

Semester 1:
L2 Acquistion Theories & Methods Course
- Basics of socio-cultural (historical) theory and Systemic Functional Linguistics taught

Semester 1:
Towards End of the Semester
- Submission of "instructional plan" for a single lesson (QUAN)

Semester 2:
Methods & Assessment for ESL/Bilingual Ed
- Mohan's Knowledge Framework introduced
- "Instructional plan" for full unit submitted and based in KF (QUAN)
- Mentor-professor observation with rubric (QUAN)

Post-Coursework
- Interview completed (qual)

Fig. 1 QUAN(qual) research design

(other than Language Arts if an elementary teacher) that included learner outcomes for oral language production and written language production among other elements. The basic requirements of the two initial lesson plans can be found in Table 1. This assignment was given with a rubric that provided questions to have teachers consider the course work they had been doing. In the second semester, teachers were required to design an entire unit using Mohan's Knowledge Framework (1986) to identify aspects of a content topic (such as types and causes of genetic disorders) to be learned and the associated language functions to be realized through the use of specific linguistic resources. An example from one of the teachers of a completed KF for a unit on Genetic Disease is shown in Table 5. Such instructional design pushes teachers to consider how the preferred thinking related to specific content learning could be realized linguistically. The baseline lesson plan, lesson plans after instruction in the first semester, and the unit

Table 1 Basic requirements for the lesson plans

Requirements	Components	Materials
Planning for integration: Based on the curriculum you are currently using in the school, design two lessons that integrate content and language instruction at the level of objectives/ outcomes, instructional activities, and assessment	• Identifying information: grade level, content area, learner description for accommodation/modification • Two lessons for the same content topic you want your students to learn about: one focusing on the development of spoken language; one on the development of written language; • For each lesson, objectives need to be explicit for both content outcomes and language outcomes (use Model Performance Indicator, WIDA); • For each lesson, student activities/ formative assessments will require students to demonstrate the achievement of the content and language outcomes; • For each lesson, visuals/graphic organizers are used to facilitate students' thinking, comprehension, and communication; • A comment section on 1) principles of language development addressed by the lesson plans; 2) activities that engage students in various thinking processes; 3) activities that facilitate the development of CALP; 4) activities aligned with the established objectives/ outcomes; 5) activities that facilitate both content learning and development of language associated with the target content.	Instructional materials you are currently using in the school; Course reading materials.

design collected in the second semester were all analyzed using a pre-designed 1–4 rating scale, with 4 indicating the highest level of performance, followed by paired t-tests.

Classroom observations

All teachers were observed at least twice during the period of the initial two courses: The baseline was taken within the first three weeks of entering the program, and the second observation took place toward the end or after the first semester. The far left column of Table 2 shows the elements of the form used in observations. Modified to align with course content and the 2012 WIDA Standards, the form is loosely based on the Sheltered Instruction Observation Protocol, SIOP (Echevarria *et al.* 2008). The pre-designed observation rating scale ranged from highly evident (4) to not evident (0). The completed observation rubric was analyzed using a paired t-test.

Finally, analysis of all data followed a recursive process as the researcher team read and reread the results of different data at different times to clarify their understandings of student work and the statistical results, and how these connected to the themes that emerged from interview data.

Results

The results demonstrate the teachers' increased abilities to appropriately instruct linguistically diverse students. The interview data complements these findings and

Table 2 Classroom observation

	Baseline		Second assessment		Paired t-test results	
	Mean	Std Dev	Mean	Std Dev	*t*-test	*P*-value
Students' prior knowledge related to the new content activated and/or assessed	2.87	1.42	3.83	1.114	3.075	.006
Students' prior knowledge related to the new language features activated and/or assessed	2.09	1.54	2.91	1.443	2.413	.025
Background knowledge built to facilitate new learning when needed	2.65	1.61	3.91	1.164	3.051	.006
Key vocabulary, focus sentence structures, and salient discourse features highlighted, taught, and required to be used by students	2.96	1.49	3.74	1.010	2.657	.014
Prior knowledge & background	2.64	1.24	3.60	.913	3.626	<.001
Speech and written material appropriate for students' proficiency level	2.70	1.26	3.87	1.10	2.929	.008
A variety of techniques used to make content and requirements clear	3.09	1.04	4.13	1.18	3.006	.006
Student activities require student use of required language features in demonstration of content understanding	2.61	1.27	2.87	1.69	2.170	.041
Language output required to be in the form of both speaking and writing related to the content focus	2.22	1.51	3.30	1.46	2.737	.012
Comprehensible input & pushed output	2.65	1.01	3.68	.751	4.041	<.001
Tasks conducted to promote higher-order thinking skills with reduced linguistic demands for ELLs	1.91	1.31	3.43	1.16	6.076	<.0001
Graphic organizers, demonstrations, prompting techniques, etc. used to connect language functions to various thinking skills	1.91	1.28	3.00	1.57	3.014	.006
Appropriate graphic organizers used for organizing and communicating knowledge by both the teacher and the students, and to encourage students producing longer discourse related to the content focus	1.96	1.40	2.78	1.38	2.141	.004
Activities provided for students to demonstrate defined academic content learning and to use the required language features to achieve the lesson objectives in the classroom	1.91	1.13	3.35	1.43	3.813	<.001
Activities integrate the use of all language skills for communicating about the content focus	2.17	1.30	3.70	1.52	4.288	<.0001
Activities provide opportunities for interaction and discussion between teacher/student and among students, which encourage elaborated responses related to the lesson content objectives	2.13	1.29	3.48	1.28	3.496	.002
Grouping configuration support language and content objectives of the lesson	1.96	1.30	3.43	1.53	3.398	.003
Strategies & activities	1.99	1.14	3.31	1.09	4.710	<.0001
Student activities conducted as formative assessments for content learning relation to the lesson content objectives	2.39	1.53	3.96	1.11	4.281	<.0001
Student activities conducted as formative assessment for language development related to the lesson language objectives	1.96	1.43	2.87	1.58	2.192	.039
Regular feedback provided to students on their output	2.61	1.53	3.96	1.15	4.080	<.0001
On-going assessment of student comprehension and learning of all lesson objectives	2.87	1.69	4.04	1.15	3.127	.005
Review/Assessment	2.46	1.35	3.70	.990	4.257	<.0001
Overall measurement tool results	2.37	1.07	3.53	.871	4.717	<.0001

All *P*-values demonstrate a statistically significant increase in the mean at the second observation

shows teachers' greater knowledge of the linguistic complexity of schooling, the diversity of the immigrant experience, and their instructional responsibility. To address our research question, we examined the change in teachers' perceptions from their knowledge acquisition and then connected these to how their practice changes. The findings driven by the interview analysis informs all the other results and gives voice to the teachers who participated in this research as sought with an embedded mixed methods approach (Creswell 2014, p. 231).

Teachers' knowledge acquisition

The full interview and responses from the teachers go beyond the scope of this paper. In presenting the findings based on the survey and interview data, we limit our attention to only their perceptions relevant to our research question. While teachers' "concerns about ELL students' academic and behavioral skills may actually be a reflection of their ability to meet ELL students' instructional needs" (Cheatham *et al.* 2014, p. 54), we see teachers' knowledge acquisition as the starting point for improved instructional ability.

After looking back on the pre-survey, teachers were asked, "As a result of having completed the coursework, can you tell me what you would take into consideration before teaching your content that you would not have considered prior to these classes?" The major themes that emerged were attention to language and differentiated instruction.

Attention to language

Comparing the pre-survey data with teachers' responses in the interviews, we have noticed increased attention to students' language development. This attention to language reflects a functional perspective that views language as content specific and a resource of meaning that goes beyond vocabulary to recognize discourse (Huang and Mohan 2009a). Thus, an attention to teaching language/literacy skills entails the recognition of the context in which language/literacy skills are used and the language features at discourse level. Math and language arts were content areas highly represented by teachers in the study (32 % and 61 %, respectively): A comment from each content teacher demonstrates the increased understanding of the complexity of language and the need to explicitly teach it.

> You need to come up with the language and teach the students how to address…the language of math, the discourse level. So, in designing my math lessons, I will definitely think about that, how to highlight the language of math at the discourse level in addition to vocab…and just that it's the way the sentences are structured too. (Collette)

Collette's response demonstrates the growth of a teacher who previously had answered on the pre-survey, as 93 % of the cohort did, that vocabulary is the most important aspect of content language which tends to be a traditionalist view; however, a functional linguistic approach starts from the context, such as the discipline of math, and embraces discourse features as important linguistic resources. This changing perception that associates language to specific disciplines and treats language instruction as going beyond vocabulary to embrace discourse was also seen in responses from language arts specialists. For example, when asked what she would take into consideration, Janet replied,

That concept of using a discourse within your classroom. But I hadn't really had the framework of the different registers and the specific structures that are in place and the entire concept of explicitly teaching that to the students was kind of foreign to me…I hadn't really considered doing that before whereas now I see how valuable that is for students and how effective it is…how to actually explicitly teach that language so they're able to engage in that discussion instead of being perplexed that it wasn't happening.

This attention to language in their instruction in order to realize the desired content production occurred more than any other theme in response to the question (19 occurrences/16 teachers).

Differentiated instruction

The next largest category, differentiated instruction, appeared in the talk seven times by different speakers. Most of the teachers had learned about differentiated instruction as an effective way to help students with special needs. Unfortunately, when it comes to ELLs, without an understanding of second language acquisition and language proficiency, teachers may discount the role of language and its impact on students' academic performance (de Jong and Harper, 2005) and tend to identify causes of students' academic struggles as related a learning, developmental, or emotional difficulties (Cheatham *et al.* 2014). This misidentification of the root of students' learning difficulties may result in the kind of differentiated instruction not addressing the specific needs of the ELLs. However, as argued by many researchers (Santos *et al.* 2012; Wong and Snow 2000), "appropriate identification of classroom difficulties associated with students' second language acquisition, as well as means to appropriately educate these students, logically requires detailed information about students' English language proficiency in addition to other individual, family, and school contextual information" (Cheatham *et al.* 2014, p. 54). In our study, the teaching of contextualized second language acquisition and language proficiencies seems to have initiated the teachers into a consideration of differentiated instruction that target students' linguistic needs as defined in the Features of Academic Language by WIDA (www.wida.us). WIDA proficiency standards, heavily influenced by SFL, defines language/literacy proficiency in the context of specific content areas and grade level. Thus, it requires teachers to view language diversity not only as a variety of different mother tongues, but also variations of students' English proficiency levels by content and grade level. This contextualized view of language proficiency presents a totally different perspective when it comes to addressing students' specific linguistic needs for academic success. In the program, many teachers had some knowledge that ELLs are classified into different levels of language proficiency, but the concept of content specific language proficiency was a new idea even to teachers who had been endorsed as ESL specialists. The program seems to have helped the teachers to start thinking about variations of language proficiency as a need for differentiated instruction. In teachers' responses, the recognition of different proficiency levels as defined by WIDA Standards and planning for them was often coupled with an increased sense of responsibility:

You know what really truly? This sounds terrible, but I never considered the levels of those kids. And, I think, now, I'm going to look at those kids and what can I do as

the classroom teacher. What can I do to help you have success in my room that falls back on me. So I'm going to look at their levels and then I'm also going to look at what I can do instead of pawning it off on someone else and having someone else do my job. (Katy)

Katy, a veteran rural high school science teacher with no experience in learning a second language, had gained an understanding of cultural diversity in her community by teaching in a school with a recent increase of ELLs to 50 % of the student population. Nevertheless, while trying to make her ELLs welcome in her science class, she had never made the connection between her ELL students' inability to perform academic tasks at the desired level and her lack of consideration to teach language for science in her discipline specific teaching context. The comment in the interview illustrates Katy's growth from no consideration for students' linguistic needs to taking ownership of her classroom and the success she can foster with her students by attending to the contextualized linguistic needs of students at different language proficiency levels.

Perceived change in practice

The question about considerations for practice was followed up with a question about change to practice: "What difference, if any, do you expect to emerge in your classroom as a result of having taken the coursework?" The most common response (11 occurrences from different speakers) centered on student engagement with language. Two subcategories emerged with teachers who focused more on student engagement or "ownership", and teachers who focused on target output. Jenny, a high school language arts/journalism teacher, blurs these two subcategories to demonstrate this dominant theme of student engagement as voiced through content language:

Lately, it's been student engagement…I'm trying very deliberately to make sure that I am holding students accountable to those objectives and finding ways to assess them on it. And, while I'm still struggling to find out how that works, it's been interesting to see the kids' reaction to them. So, in some cases, I see kids using more of the vocabulary. Like a kid came in class today and said, "Oh, are we still discussing media?" Instead of asking "Are we doing the TV thing?"

Jenny works with an at-risk population within a juvenile correctional facility and like other teachers in the program, she immediately began implementing ideas she was gaining through this professional development program. Though the comment on student use of language is still limited to content specific vocabulary, the teacher seemed to have realized the importance of focusing on student output in language use as a way to assess learning and "hold students accountable" to the learning objectives. Other responses at three to six occurrences from separate speakers included (a) a more student-centered instructional approach, (b) respect for students' first language, (c) the use of Mohan's Knowledge Framework to design instructional activities that integrate discipline specific content learning and form-function connections for meaning construction. Their attention to and perception of change in practice can also be seen in the lessons/units the teachers began to create and the observed instructional practices.

Documented change in teachers' professional practice

While survey and interview data revealed teachers' acquisition of knowledge and change of perceptions, the findings from instructional planning and classroom observations provide statistical evidence of the impact of the project on teachers' professional practice.

Integrated instructional planning

WIDA, adopting a functional linguistic view as its theoretical foundation, emphasizes that language serves to perform different functions, such as classifying, comparing, explaining, justifying, etc. Mohan's KF provides a principled account of how different language functions associated with a single content topic (*e.g.*, Genetic Diseases) are realized by explicit linguistic features at the lexical, syntactical, and discourse levels. Thus, the introduction of the KF as a guide for instructional planning intended to draw teachers' attention to a variety of language functions that may be needed for students' demonstration of a more comprehensive understanding of a given topic. To examine teachers' change in instructional planning, the pre-designed rubric rated the teachers' use/appropriateness of content outcomes, language outcomes (including vocabulary, and sentence or discourse levels), accommodations for various language proficiency levels, activities/assessments to achieve both the outcome set and Bloom's higher thinking skills, and visual/graphic support for both input and output. The baseline lesson plan was compared to the lesson plans completed towards the end of semester 1 that integrated language and content. Both of these results were compared to the unit design that students were asked to create using the KF during second semester. Within the unit, all lesson plans should have included the components listed in the rubric. Table 3 displays the results of these paired t-tests.

The change between the initial baseline lesson and integrated lesson plans are statistically significant $t(22) = 10.698$, p < .0001. While there is not a significant change from the integrated lesson plans to the unit design on the KF, the difference between the unit design and the baseline is statistically significant, $t(22) = 7.254$, p < .0001, as shown by Table 3. The Cronbach Alpha reliability score for the pre-designed rubric was .783 for the baseline, and .741 for the unit design. A Cronbach Alpha requires a score of .70 or higher to demonstrate the reliability of a measurement tool. The rubric, however, came up slightly short,

Table 3 Instructional planning: baseline, content/language integrated lesson plans, unit design

Overall results by evaluation guide

	Baseline lesson plan	Planning for integration	Unit design
Sample size	23	23	23
Cronbach alpha	.783	.676	.741
Grand mean	1.76	3.28	3.04
Standard deviation	.56216	.44587	.57583

Overall Mean Score Differences by Evaluation Guide

Pairs for analysis:	Mean difference	Standard deviation	*t*-test value	df	Significance (2-tailed)	Comment
Baseline lesson plan – integrated lesson plans	−1.52	.68221	10.698	22	p < .0001	Significant
Integrated lesson plans – unit design	.239	.61919	1.852	22	p = .077	Not significant
Baseline lesson plan – unit design	−1.28	.84797	7.254	22	p < .0001	Significant

.676, when applied to the integration lesson plans; therefore, the significant growth from baseline to unit design—completed toward the end of both semesters—is the better indication of the teachers' ability to plan for linguistic diversity. Table 4 provides an example of teachers' change in instructional planning that is typical of the participating teachers. Baseline lesson plan shows a focus on writing in isolation from ideational content. Neither the objectives nor the activities provided concrete guidance for desired student output. However, the lesson plans produced later reveal a much clearer focus on content related language development that not only tentatively addresses student's proficiency level, but also embraces explicit linguistic features desired for student use. Though still confused in the use of jargons (such as language functions), the increase attention to content specific language development is evident.

When looking into the details of teachers' unit design based on Mohan's KF, teachers' skill development in instructional planning is evident. While lesson planning provided the opportunity to integrate language and content instruction for limited aspects of a chosen topic and language functions, an examination of teachers' instructional unit design based on the KF shows teachers' competence

Table 4 An example of teacher's change in instructional planning

Baseline lesson plan	Planning for integration (mid-point)	Lesson from the unit design
Topic: None.	**Topic:** What a tree needs to survive.	**Topic:** Seasons
Objective: Students demonstrate growth in writing from instruction based on previous formative writing sample.	**Model Performance Indicator:** Level 2 Students will practice using sentences with partners that tell things that a tree needs to stay healthy by using the sentence stem "A tree needs_____." and visuals.	**Language Function:** Categorization
Review sequencing and demonstrate sample writing. Brainstorm ideas for topic. Students write as I roam room giving help and individual instruction. Students gather for share time. Volunteers read product. Grading done using district writing rubric.	**Language Objectives:**	**Content understanding to be demonstrated:** the clothing people wear changes as the seasons change
	Listening SWBAT point to pictures of what a tree needs to survive when prompted.	**Language Features that are important for students to use when demonstrating understanding:**
	Speaking Explain orally to a partner what a tree needs to survive using the following language features: sentences.	**MPI:** TSWBAT: sort clothing by the season in which they are typically worn by looking at a classroom graph of clothing
	Vocabulary: Sun, soil, rain, wind	**Language Objective:**
	Sentence structure: noun/verb agreement in: "A tree needs_____."	**Vocabulary:** use "spring, summer, fall, winter, change" in speaking to categorize clothing by the season in which they are worn
		Sentence: use "Now the girl/boy is wearing (type of clothing) because it is (name of season)"in speaking to categorize clothing by the season in which they are worn
		Discourse: use "Now the girl/boy is wearing (describe clothing) because it is (name of season). Next it will be (name of season). In the (name of season), you can wear (type of clothing)."in speaking to categorize clothing by the season in which they are worn
		Activities:

in making systematic connection between a wide range of topic-related language functions and various content-specific linguistic resources. For instance, in the unit on genetic diseases as shown in Table 5, we have noticed a deliberate link between aspects of a chosen topic (such as types of genetic disorders) of which the students would demonstrate an understanding, and the various language functions (such as classifying, describing, explaining) that the students would need to use specific linguistic resources (i.e., vocabulary, sentence patterns, and discourse devices) to realize. It seems that the KF has played a role of a structured guidance for teachers to incorporate a language focus in the teaching of all aspects of a chosen content topic.

Classroom observations

The results of the two observations, conducted at the beginning of the PD project and at the end of the first two courses, are shown in Table 1. The Cronbach Alpha for the assessment instrument shows reliability with a .931 score.

The finding shows a significant effect of the teachers' professional development on paired t-tests, $t(22) = 4.72$, p < .0001, based on the observational data. The teachers' increase in means at the second observation is statistically significant at the specified .05 level in relation to building prior knowledge, comprehensible input and pushed output, strategies and activities, and review/assessment at 3.60(.913), 3.68(.75), 3.31(1.09), and 3.70(.99), respectively. The increase in strategies and activities, in

Table 5 Sample of an instructional unit based on Mohan's KF - biology

Genetic diseases		
Classification	Principles	Evaluation
Outcome: Classify genetic disorders into four categories **Thinking Process:** classifying **Activity:** Read materials about the categories of genetic disorders and briefly define characteristics of each one with appropriate sentence pattern. ***Essential Language:** chromosomal abnormalities, single genetic defects, multifactorial problems, teratogenic This disorder is a _____.	Outcome: State specific causes for specific genetic diseases i.e. Radiation, genetics, etc. **Thinking Process:** explaining, inferring, interpreting **Activity:** Use defined characteristics notes and graphic organizer to discuss in small groups. ***Essential Language:** …are known to cause… …resulting in…	Outcome: Rate the pros and cons of a specific genetic disease? **Thinking Process:** analyzing, judging, evaluating **Activity:** Computer research with questions chart on a specific genetic disease and state the good and bad of it (if possible). Individual and whole class rating. ***Essential Language:** One advantage is… Although, this may also… The (dis)advantages include…
Outcome: Describe one genetic disorder from each of the four categories **Thinking Process:** compare/contrast **Activity:** Study and take notes one genetic disease from each category and be able to share notes and expand on them orally with small group. ***Essential Language:** …may be inherited… …chromosomes… inversion, translocation, deletion	**Outcome:** Tell how are these genetic disorders transmitted from one generation to the next? **Thinking Process:** ordering **Activity:** Find examples of genetic disorders and research how they are inherited. Complete sequence of events chain. ***Essential Language:** This leads to…	**Outcome:** Tell what are the benefits or detriment of knowing the human genome? **Thinking Process:** making a decision, analyzing, evaluating **Activity:** Computer group research on human genome, short Powerpoint presentation must include pros and cons
DESCRIPTION	**SEQUENCE**	**CHOICE**

ªEssential language taken from a corresponding chart from teachers' unit design

particular, demonstrates that after the initial course the teachers provided greater support for language and thinking in connection to the content and language objectives. This strengthened alignment illustrates that the teachers could implement what they had learned in the course in terms of theory and their application of it. In conferencing with teachers after observations, many of them expressed a greater sense of empowerment with the ability to make connections back to the objectives. In the urban school district teachers had been using SIOP-inspired content and language objectives, but as one math teacher said, "I'd just write 'em up on the board and don't really know what to do with them. But now I know how to really use them" (Sofie).

Discussion

Research shows that the simultaneous learning of language and content requires teachers' (a) understanding of how language works in content, (b) planning for it across a unit, and (c) supporting students' linguistic engagement in classroom activities (Schleppegrell and O'Hallaron 2011). Our study, drawing upon different sources of data, has managed to demonstrate how a systemic functional approach to PD can engage teachers in growth in all three aspects. The majority of teachers in the pre-coursework survey had stated that they considered vocabulary key to the content. They seemed to have been heavily influenced by the "keyword" approach (Atkinson 1975) that has been promoted by the school districts over the years. It may have been that they had a broad understanding of the word and it was the only way they could describe the language and ways of talking about the content of their discipline, however, this unexamined and fuzzy knowledge changed to a more nuanced and complex way of thinking. This more concrete knowledge about language can be seen in the quotations from Collette and Janet. An increase in linguistic sensitivity in turn led to an increase in recognition for the different language levels as defined by WIDA, and the essential need for culturally responsive instruction (Cartledge and Kourea 2008; Garcia and Ortiz 2006). Ultimately, the teachers' increased linguistic sensitivity was reflected in their design of a teaching unit and actual instructional practice that supported students' linguistic engagement in the process of content learning.

In relation to the research question, the study shows that linguistic awareness does make an impact on teachers' practice to instruct for content specific language/literacy. We see how a change of perceptions and beliefs from knowledge acquisition leads to a change in professional practice including instruction in the classroom.

The Evaluation Task showed an increased use of rubrics related to student use of language in their writing. The lesson plans and unit design by the teachers demonstrated the increased ability to prepare for language specific content instruction. Finally, this ability to plan was not limited to the paper: teachers increased their in-class instructional abilities as can be seen in the classroom observation results.

While an increase in teachers' linguistic sensitivity in both planning and instruction is evident, findings also reveal areas for more questions and further research. For example, even if the teachers have become capable of framing very explicit language objectives at vocabulary, sentence, or discourse levels, the rubrics that teachers tended to use for the written samples were extremely broad for use of linguistic resources so that if students had missed the instruction on the target language for the assignment, they would

have difficulty recovering the intended outcome whether on the vocabulary, sentence, or discourse level. How to help the teachers better connect the assessment tool, particularly rubrics, to established learner outcomes for student language use remains a challenge for both teachers and researchers.

There are limitations of the study. Since data were collected within 8 months after the launch of the program, the findings are limited in scope and depth. Also, the teachers who took part in this professional development opportunity were either enticed by free college coursework and/or realized that they were not prepared for the growing linguistically diverse population in their classes; therefore, this sample may not be reflective of the many teachers in classrooms who similarly face such diversity but do not, for a myriad of reasons, seek development on serving these students.

Conclusion and implications

To fill in a gap in research from a functional linguistic approach to teacher development for incorporation of language/literacy instruction in content area teaching, the study has managed to demonstrate not only how a SFL approach can be utilized to facilitate K-12 teachers' acquisition of knowledge in a variety of content areas, but also how teachers' change of perceptions actually lead to skill development in instructional planning, which resulted in improved classroom instruction promoting students' academic language/literacy development.

While American schools do not have enough graduates from traditional teacher education programs prepared to work with linguistically diverse populations (GAO, Government Accountability Office 2009), our study indicates the potential of a professional development program that integrates a brief introduction to theory, a heavy dose of readings from SFL scholars, and a variety of activities/assessments for language learners, accompanied by on-site observation and mentoring. The rise of the Common Core and its emphasis on literacy in the content areas may push for increased preparation of all teachers for instructing the language of their discipline, and providing the supports to help all students demonstrate it.

This research revealed that more attention to explicit language instruction increases teachers' abilities to teach their content. Since research shows that teachers must know both content and the language used to realize content (Schleppegrell 2004; Gibbons 2009), we hope this study can provide some resources and ideas to assist teacher educators. Colleges of teacher education need to give higher priority to assure that all pre- and in-service programs develop teachers capable of designing appropriate instruction for linguistically diverse students struggling under traditional pedagogical practices that leave teachers feeling unprepared (Balderrama 2001; Darling-Hammond *et al.* 2002; Gandara *et al.* 2005).

For future research, longitudinal studies on the impacts of such kind of teacher development programs on student change in academic performance would be useful to address several questions: First, the classroom practice observation revealed nuances when knowledge and beliefs are translated into practice. While becoming more sensitive to language use as evidenced by teachers' attention to language features at the three levels and their oral conversation with the students when assignments are returned, we wonder how teachers would provide follow up instruction without an assessment design specifically related to the detailed language objectives. Second, what is the

impact of such kind of teacher development on students' academic performance over time? The grant that supported this research was distributed in such a way that we were unable to compare individual student school performance over an academic year. We were limited to a semester when collecting this data, thus focusing more on teacher performance alone. Full cycles of instructional objectives, student performance, feedback from teachers, and follow-up student performance on similar tasks with the same group of students would provide data to reveal teacher effectiveness on student learning as a result of teacher development. Third, what is the lasting effect of such kind of professional development on teacher practice? Three years from now, after having completed this study, it would benefit us to follow up with the teachers to determine whether or not they are still attentive to the language demands of the curriculum content they teach. Finally, how are state teacher evaluation systems compatible or not compatible with linguistically informed education across the curriculum? After all, teachers' performance is heavily influenced not only by their beliefs, but also external force coming from local, state, and federal authorities. An answer to this question would have implications for all stake holders.

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