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Using Urban Ecology as a Transdisciplinary Approach for Teaching English Learners

Teams from the Center for Equity for English Learners (CEEL) and the Center for Urban Resilience (CUREs) at Loyola Marymount University collaborated on multi-year projects to implement the *Urban Ecology for English Learners Projects* designed to implement a professional learning and curriculum model to explicitly engage students in experiences where they learn science content through investigations of their local schoolyards and neighborhoods while simultaneously advancing language and literacy skills. This partnership empowers educators to leverage the interdisciplinary science of urban ecology and resilience as a way to democratize access and opportunity for English Learner students in diverse urban settings.

Keywords

Urban Ecology, English Learners, Teacher Professional Development, Interdisciplinary Instruction

INTRODUCTION

Urbanization represents the single biggest demographic transition in modern human history (United Nations 2019). The ecosystems created by the building of cities have transformed the social, economic, political and biological characteristics of the way in which the majority of the world's populations now live (Pickett et al. 2020). Understanding this phenomenon as an extant ecological reality is a crucial challenge for the 21st-century. Core issues such as climate change, food security, public health and social justice all have unique interpretations when viewed through the lens of urban ecology. As such, our *Urban Ecology for English Learners* project presents an opportunity to implement a professional learning and curriculum model that integrates the interdisciplinary science of urban ecology and resilience to address science education as the new civil rights agenda for diverse urban students (Tate 2001). We view the opportunity to use urban ecology as a content focus for engaging English Learners¹ as intellectually robust, potentially transformative, and a cornerstone in protecting the democratic participatory process.



Image 1. English Learner students conducting a field study on ecosystem structures.

CONTEXT

The science of Urban Ecology (UE) provides an opportunity to reframe social challenges (Lord et al. 2003) by integrating natural and social sciences to understand urban communities as systems and to manage human effects on ecosystems (Pickett et al. 2001; DeStefano & DeGraaf 2003; Alberti & Marzluff 2004; Pickett et al. 2020). The opportunity value is further bolstered by the recognition that science content in upper elementary and middle school classrooms can fall as low as 8.8% of instructional time per week (Hoyer & Sparks 2017). The modern focus on

¹ The term English Learners is used to refer to students who speak a language other than English and who receive specialized instruction in English and, if enrolled in a Bilingual/Dual Language program, also receive instruction in their primary language. The authors acknowledge and encourage the use of the term emergent bilingual learners given it focuses on the potential to leverage bilingualism as a resource, both cognitively and socially (Garcia, 2009).

language and literacy can leave little time for science immersion. We believe that the novel use of urban ecology in service to language instruction helps to ameliorate this problem.

Our Curriculum Intervention

The initial development of the urban ecology curriculum began as a high school project developed by a team from the Urban Ecology Institute in Boston and faculty from Boston College, supported by an instructional materials development grant from the National Science Foundation (NSF #0628143, Strauss PI). The UrbanEcoLab project exists as a freestanding, one year science course, available free of charge as a downloadable set of 13 modules and over 100 lessons (<https://academics.lmu.edu/ures/partners/k12teachers/urbanecolab/>).

Our current projects drew from this base, combining the work of two Centers at Loyola Marymount University in Los Angeles. Teams from the Center for Equity for English Learners (CEEL) and the Center for Urban Resilience (CUREs) collaborated on multi-year projects designed to explicitly engage students in experiences where they are learning science content through investigations of their local schoolyards and neighborhoods while simultaneously advancing language and literacy skills. Student interest in science is stimulated and retained using these curricula since the majority of ELs' families live in urban-centric areas (Barnett et al. 2011; McNeill et al. 2011; DeBay et al. 2012). Subsequently, motivation and engagement are increased for minority students and ELs when science is “connected to real-world problems in the school community” (Bouillon & Gomez 2001).

Three upper elementary/middle school Urban Ecology for English Learners curriculum modules were designed to bolster English language and literacy learning by providing access to standards-based, rigorous science content to English Learners in fourth through eighth grade in select schools across five school districts in the greater Los Angeles area. Project teachers and site-level coordinators were an integral part of developing these *transdisciplinary* curriculum modules, providing feedback on their content, sequence, and standards alignment. The curriculum emphasizes locally relevant field studies and is multiply-aligned with science, literacy, and language standards. Each module (see Figure 1 for sample Module 1 overview) includes six instructional units with over 22 lessons that develop inquiry-based integrated English language and science emphasizing expository/informational writing and oral language development. Academic writing in science for ELs (Quinn, Lee, & Valdés 2012; Minicucci 1996) is particularly essential given the focus of the National Common Core Standards. The modules culminate with an action-oriented project consisting of an inter-related science and literacy product. Pre- and post-module assessments are used to measure acquisition of scientific concepts, vocabulary and informational text writing skills (for details, see Armas et al. 2020).

URBAN ECOLOGY CURRICULUM FOR ENGLISH LEARNERS*

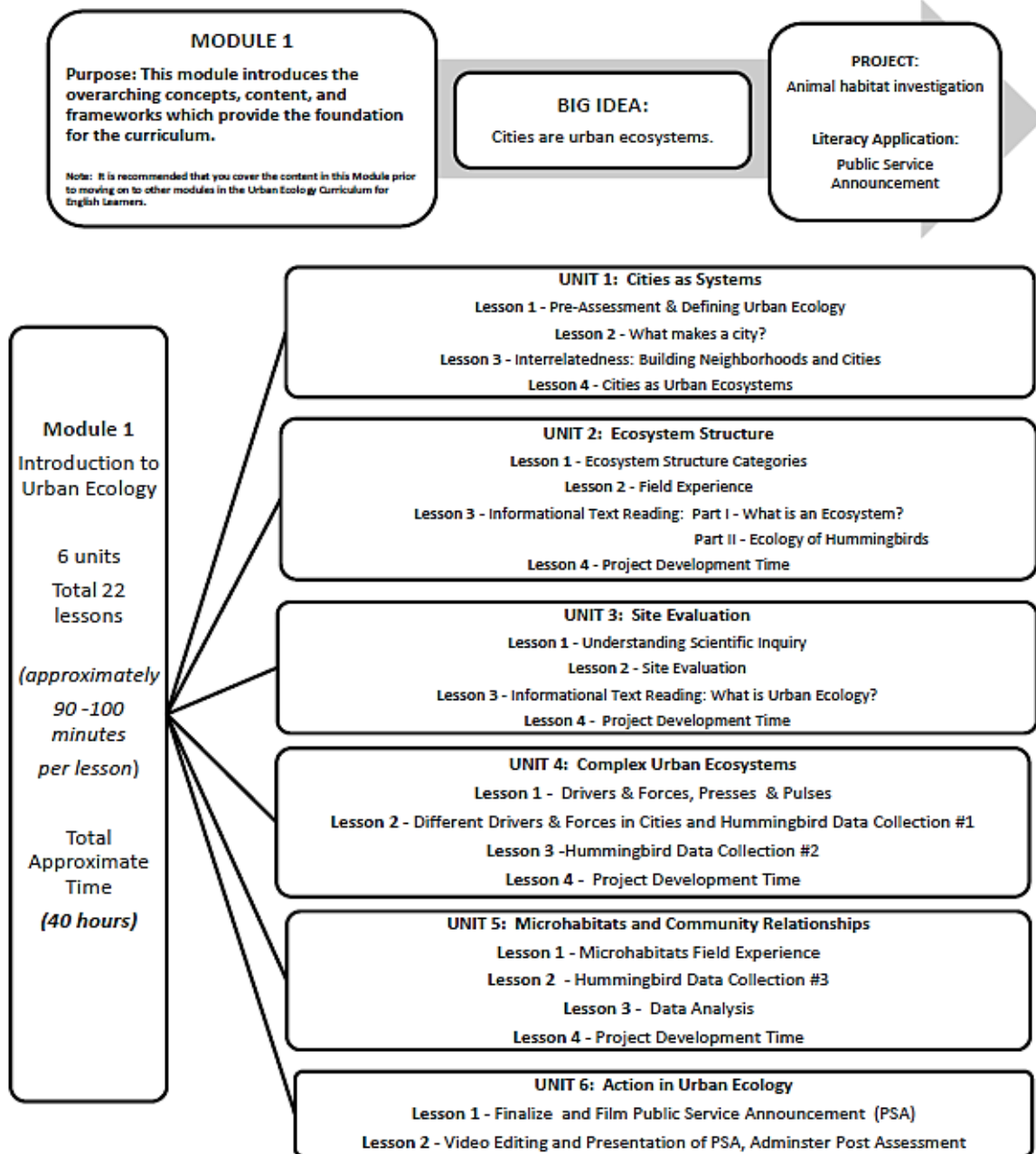


Figure 1. Overview of *Urban Ecology for English Learners Module 1: Introduction to Urban Ecology*.

GOALS

The implementation of the Next Generation Science Standards (NGSS) continues to present opportunities and challenges to “create a rich language-learning and practice-oriented science classroom environment, provided teachers ensure that ELs are supported to participate” (Quinn, Lee, and Valdés 2012). Attending to these recommendations is critical if we are to reverse trends in National Assessment of Educational Progress (NAEP) data that show only 19% of

eighth grade ELs scored at or above the basic level in science, as compared to nearly four times that number (71%) of English-only students (US DOE, 2015). To address these challenges and call to action, our Centers collaborated to implement the *Urban Ecology for English Learners Projects* with funding from U.S. Department of Education National Professional Development (NPD) and National Science Foundation (NSF) grants. Over the course of seven years (2012-2019), this effort resulted in the creation of curricular resources, professional learning models, and tools to increase the quantity and quality of science instruction for ELs in grades 4-8 who were Long Term English Learners (LTELs), or at-risk of becoming LTELs. The projects' primary goals were to (1) increase teachers' knowledge and skills in delivering STEM education for ELs; (2) increase ELs' science achievement and engagement in Urban Ecology; and (3) bolster ELs' scientific disciplinary academic language skills and access to inquiry-based science.

APPROACH

Transdisciplinary Instruction

We employed a transdisciplinary instruction approach to integrate science, literacy and language development. The strategy for implementing the Urban Ecology for ELs projects consisted of several components: (1) system and site-level leadership technical assistance and collaboration; (2) identification and development of teacher leaders across designated school sites to support implementation; and (3) sustained, recurring professional development focused on integrated science and language teaching; and (4) classroom observation and peer coaching.

Professional learning sessions included annual 3-day summer institutes coupled with a series of three-hour follow-up sessions throughout the year. Collaborative learning agendas included delivery of simultaneous science, language, literacy and inquiry-based content focused on research-based practices for teaching, learning and assessment for ELs. Lead teachers and on-site coaches provided support and feedback based on classroom observational data. On-going professional learning sessions allowed for cross-disciplinary collaboration and discussion of approaches to assist teachers in maximizing opportunities to increase instructional time in science and to support students' scientific research.

Implementing and Evaluating the Curriculum

Our projects engaged 126 educators, including district and site-level leaders in 5 school districts and 13 school sites in an urban area of Southern California over the course of seven years. During the project's second phase, a subset of the 126 teachers (N=14) from one of our partner districts engaged in continued collaboration. Students enrolled in project teachers' classrooms received instruction in the project curriculum for at least one year.



Image 2. Teachers engaged in a professional learning session focused on the Urban Ecology for English Learners Curriculum.

Two research questions guided project evaluation inquiry: 1) How does a transdisciplinary model for professional development in Urban Ecology for ELs support teacher learning of both content and pedagogy?; and 2) What are the effects on student outcomes as measured by a pre- and post-student writing assessment and state-level language and academic assessments²?

KEY RESULTS

Inquiry Question 1: Professional learning support for EL science teaching and learning

Project teachers found the Urban Ecology for ELs Modules' content and resources to be useful, pertinent, and exemplary of interdisciplinary instruction. Results from the Teacher Survey, Journey Showcase artifacts, and teacher reflections also indicated growth in teacher practices in using Urban Ecology Scientific Inquiry processes in tandem with EL research-based practices through a Transdisciplinary framework. Overall, this project affirmed the efficacy of an integrated PD model focused on STEM literacies for LTELs. The following representative quotes capture teachers' perceptions:

*"I loved seeing how **excited** and **proud** my English-learner students felt as they were able to study urban ecology and understand challenging science content and vocabulary."*

– Middle School Teacher

"This program has a positive impact on my students because I'm using many of the strategies while teaching the Urban Ecology for English Learners curriculum and also in other content areas."

– 4th/5th Grade Teacher

² The California English Language Development Test (CELDT) for English language proficiency and the Smarter Balanced Assessment System summative test in English Language Arts were used to determine growth and outcomes for this project.

By the end of the project, teachers' overall mean rating was 4.1 on a 5-point scale ("High") on knowledge, skills and practices in developing science content, language and literacy learning for ELs. Teacher survey results showed evidence of confidence and implementation of the interdisciplinary practices and most project strategies. See Figures 2 and 3 for examples of teacher documentation of application and use of research-based strategies.

Inquiry Question 2: Effects on Student Learning Outcomes

Reclassification. A benchmark for EL students is to "reclassify" as fluent English proficient (RFEP) upon meeting academic and language proficiency criteria in English. Of the EL students for whom data were available (n=103), end-of-project results indicated that 73% (n=75) were reclassified as RFEP; 27% (n=28) remained ELs, with 46% (n=13) of these receiving special education services.

Academic Achievement. EL students' progress on English Language Arts state-level academic achievement assessments indicates that from pre to post-project, the number of students in the EL/RFEP group who scored at the "Standard Not Met" Performance Level decreased by 25%. Those who scored at the "Standard Nearly Met" level increased by 21% and those who scored at the "Standard Met/Exceeded" Performance Levels increased by 4%.

Writing Assessment. Project writing assessments showed statistically significant differences in scores ($p \leq 0.05$) related to development of informational text structure, academic discourse, spelling/grammar, and metacognition/metalinguistic awareness.

CONCLUSIONS AND FUTURE PLANS

Overall, project findings are consistent with professional development (PD) research that suggests the need for more ongoing teacher support to translate research to practice (Armas, et al. 2020). Results also corroborate the importance of providing teachers with detailed, responsive, and structured PD focused on a transdisciplinary framework and research-based practices for ELs. This approach appears to increase content knowledge pedagogy and accelerates content knowledge among students. Additionally, teachers' exposure to interdisciplinary science during PD sessions translated into increased students' exposure to scientific concepts and science as a way of knowing.

Our goal is to make these curricula available similar to Urban EcoLab (NSF Award #1503519, Lavadenz PI). We are applying for additional support from the National Science Foundation and other philanthropies to bring this program to scale. The expanding field of urban ecology provides a robust platform for science learning this latest contribution of curriculum for emerging bilingual students invites a new cadre of urban explorers (*urbanauts*) into the community.

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