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Mission: to build a global community of teacher educators and to promote transnational collaboration, support, and research and development in teacher education

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EDITOR'S COLUMN

This issue of the WFATE Journal is an open topic issue It is a joy to have so many papers to publish. The blind, peer reviewers were very positive about the articles recommended for publication. Each paper is wonderfully challenging and informative

This has been a challenging time for all of us involved in education. Are schools open or are they hybrid or are they all online? How are colleges and universities planning their new years with so many uncertain issues. All over the world, educators have been rising to the challenges and working hard to ensure that students, teachers, parents, and all staff members have equitable access to the benefits of education. The need to protect people and to return to a somewhat normal existence compete and no firm answers have been found is a critical one.

WFATE made the decision to postpone the Biennial Conference until November of 2021. Because we wanted to mark the occasion of our biennium in some form, Dr, Jenene Burke, President-Elect of the World Federation of Associations for Teacher Education, has agreed to be guest editor of a special issue of the Journal that would focus on the Coronavirus impact on teacher education, teachers, schools, colleges and universities.

Call for papers – World Federation of Associations for Teacher Education (WFATE) Journal - special edition.

Learning, Teaching and Teacher Education in a Global Pandemic

Guest Editor: Associate Professor Jenene Burke, Federation University Australia
On 31 December 2019, a pneumonia of unknown cause was detected in Wuhan, China and reported to the World Health Organization (WHO) Country Office in China. This disease, later identified as a corona virus, was eventually given the name COVID-19. On 30 January 2020, the WHO declared the outbreak as a 'Public Health Emergency of International Concern' and it was finally characterized as a global pandemic on 11 March 2020. As the pandemic has swept across the globe, every aspect of our lives has been permeated, resulting in political, social, and economic upheaval. Governments across the world have responded to the global pandemic in discrete ways and these responses have caused dramatic but different effects on the way people have conducted their daily lives, influencing health, work, commerce, travel, socializing and schooling. As we manage within the crisis, and start to emerge from it, our lives and societies are destined to be changed forever.

The impact on institutions that deliver teacher education has been significant and the experiences of teacher educators are likely to vary across the world. Widespread school closures in many countries have meant that children have been confined to their homes, with their parents and carers as proxy educators, often but not always, with access to remote learning through the internet. In some countries, schools have remained open and this has prompted a different set of challenges for educators. Pandemic conditions have created an environment in which educators in general are finding ways to cope with their changed lives and have needed to rethink how to support learning with the resources at their disposal.

WFATE invites scholarly papers from its global Teacher Education community for a special edition of the WFATE journal that examines how learning, teaching and Teacher Education have fared in the conditions resulting from a global pandemic. Contributors are encouraged to identify and describe the particular conditions that are specific to their global location. Papers are invited on, but not confined to, the following topics:

- Teacher education in the context of the global pandemic
- Change - to teacher's lives, education and education systems
- Professional placements for student teachers during the COVID-19 shutdown
- Online and remote teaching
- Learning from home – online and remote learning
- Professional learning of teachers and teacher educators in pandemic conditions
- Learning and teaching in physical isolation
- Monitoring and assessing students under shut-down conditions
- Opportunities and new learnings emerging from a global pandemic
- Children's perspectives of their worlds in a global pandemic
- Parents as teachers
- School and university closures and changes to school operations.

Submissions should be sent to acshelly@aol.com (Editor) by November 30, 2020. Questions about the topics and other issues can be directed to Dr. Burke or to Dr. Shelly. The information about format and structure are found at https://www.worldfate.org/journal_submission.php.

Social Justice in Education: Celebrating Diversity, Inclusion, and Interculturalism in our Global Society

WFATE 2021 Biennial Conference

Houston, Texas USA
Friday, November 12th through Sunday, November 14th

It is the mission of the World Federation of Associations of Teacher Education to build a global community of teacher educators and to promote trans-national collaboration, support, and research and development in teacher education.

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WORLD FEDERATION OF ASSOCIATIONS FOR TEACHER EDUCATION
SIXTH BIENNIAL CONFERENCE
HOUSTON TEXAS USA
November 2021
Rescheduled due to COVID-19 Pandemic

Theme: *Social Justice in Education: Celebrating Diversity, Inclusion, and Interculturalism in our Global Society*

Paul Paese, WFATE President
Elizabeth Ward, co-chair
Debby Shulsky, co-chair

Social Justice in Education: Celebrating Diversity, Inclusion, and Interculturalism in our Global Society explores the creation of a welcoming and engaging learning environment, examining the promotion and evolutionary advancement of a comprehensive culture and environmental climate throughout resilient learning communities. As suggested by Nicky Morgan, MP, the Secretary of State for Education (United Kingdom Department for Education, 2016):

> Education has the power to transform lives and, for me, is a matter of social justice – extending opportunity to every child, wherever they live and whatever their background. Good schools and a well-educated population make our country stronger, fairer, wealthier and more secure, and higher standards in the classroom mean better life chances for everyone. Investing in our education system is an investment in the future of our nation. (p. 3)

Every child deserves the opportunity to live within a civilized society, with education acting as the instrument of social justice and basis of our culture. "The better educated our society, the fairer, more cohesive, productive and innovative it can be" (UK Department for Education, 2016, p. 5, as cited by Smith, 2018, p. 5). Embracing educational excellence also reflects the understanding, engagement and responsiveness around social justice in education.

The conference theme, *Social Justice in Education: Celebrating Diversity, Inclusion, and Interculturalism in our Global Society*, serves as a call to teacher educators to lead the way towards modeling and celebrating the transformation of lives through a civilized, educated society that embraces understandings around social justice. Reveling in diversity, inclusion and interculturalism is reflected through the following five strands that relate to the conference theme.

Strand I: Modeling Social Justice Pedagogy

Exemplary social justice pedagogy throughout education embraces the ability to model and actively engage within new understandings that are supported by the community culture. As suggested by Sehr (1997):

> Schools have long been sites for the 'socialization' of students according to dominant notions of privately oriented democratic citizenship. However, a number of critical educational theorists have argued that the schools can play an important role in promoting

> alternative understandings of democracy and can thereby help build a more democratic and just society. (p. 83)

The possibility of transformative action within society is directly aligned with the education of the members of society. For this to occur social justice pedagogy requires, as noted by Giroux (1992),

> a deliberate attempt to construct authentic conditions through which educators and students can think critically about what stands as knowledge, how knowledge is produced, and how knowledge is transformed by a particular relationship between the self, others, and the larger world. (p. 99)

How are teacher education programs promoting and implementing social justice pedagogy in transformative ways? In what ways are programs and candidates grounded in social justice pedagogy challenging or altering inequitable systems? How are policy constraints impacting social justice practices being addressed by teacher education?

Strand II: Embracing Critical Pedagogy

The politics of education and hope supports the promotion of critical pedagogy. As suggested by Duncan-Andrade & Morrell (2008), critical pedagogy places education in relationship to political, cultural, and historical context and questions the influence and power of socially constructed spaces.

The application of critical pedagogy suggests the important impact and underlying cultural understandings around the educational process. As suggested by Giroux (2018), "One of the more fundamental questions raised by educators in recent years focuses on how public school classroom teachers might develop an orientation to curriculum development and implementation which acknowledges the important underlying ethical and normative dimensions that structure classroom decisions and experiences" (p. 3). How can the application of critical pedagogy promote the transformation of society? What are the transformative roles within the instructional environment? How is plurilingual education defined and implemented? What does critically oriented multicultural education and critically-oriented intercultural education look like in teacher education?

Strand III: Preparing Educators for Global Citizenship Education

The transformative availability of global citizenship education offers multiple dimensions towards implications for practice. As suggested by (Bamber, Lewin & White, 2018):

> It involves a spectrum of possibility rather than a search for one particular thing. It implies finding a space for the unexpected and the tacit, aesthetic and relational aspects of learning. This is a significant challenge within current educational structures that are resistant to change and often prevent the envisioning of alternatives" (p.228).

What practices support global citizenship education? How is global citizenship education modeled in the classroom? In what ways can we demonstrate intercultural education? Are we preparing our teachers towards embracing cultural diversity? What practices support cultural essentialism in teacher education? How do we navigate resistance to the ideals of global citizenship education?

Strand IV: Restoring Power in Education

An understanding of transformation and power throughout the educational process is an imperative understanding to achieve. Acting as professional intellectuals and agents of change, how do we facilitate our own narrative of education and engage with powers challenging our expertise? The embedded power throughout an education system noted an underlying understanding around knowledge and pedagogy, yet Carlson and Apple (1998) suggests that,

> Indeed, conservative restorational forces would not be attacking schools so vehemently if there had *not* been gains. But perhaps even more importantly, powerful neo-liberal and neo-conservative interest groups are currently working to reinvent public education consistent with their own visions of progress. If critical educators are not able to articulate forceful new stories of progress in education, based on new ideas, metaphors, and visions of what could be, then other, less democratic and more oppressive stories of progress will win the day. The question thus is not whether progress is still possible. The question is, whose vision of progress will prevail as we enter an uncharted new century? (p. 4)

Through this lens, how might teacher educators systematically inquire into, reflect on and improve their own practice around power issues? How might policy and politics impact transformational power within the educational arena? What are the societal implications of power and influence upon the educational system? What values support and transform teacher education?

Strand V: Creating Spaces towards Embracing Relativism

Relativism is an intriguing aspect of social justice, as engaging in inquiry and a contribution to understanding creative instructional spaces is intriguing. Discourse and education are intertwined naturally, with an understanding of communications supporting social justice. As suggested by Applebaum (2018), "… truth-talk cannot be abandoned as it plays an important role in regards to the credibility of what the marginalized are trying to tell the systemically privileged about their experiences of oppression. When should questions of truth be suspended and when do they matter?" (p. 1). Further, Shanton (2011) reflects an understanding of Sosa's (2007) work around epistemic competence through an understanding and reflection of two conditions:

> Sosa (2007) claims that a necessary condition on knowledge is manifesting an epistemic competence. To manifest an epistemic competence, a belief must satisfy two conditions: (1) it must derive from the exercise of a reliable belief-forming disposition in appropriate conditions for its exercise and (2) that exercise of the disposition in those conditions would not issue a false belief in a close possible world. (Shanton, 2011, p. 89)

From these understandings of cultural relativism, an engagement in inquiry and a contribution to understandings around social awareness are embedded. Questions around active engagement within the educational environment arise. To what extent is social awareness impacting relativism? How is responsiveness impactful of relativism? How do we support anti-oppressive actions? What is considered to be injustice? What are deemed perceptions versus considerations? What is the understanding of contextualization of principles and ethics in teacher education?

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CHILDREN'S LITERATURE AS A VEHICLE FOR FOSTERING ELEMENTARY PRE-SERVICE TEACHERS' SCIENCE AND SOCIAL STUDIES ENGAGEMENT

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ABSTRACT

Pre-service teachers (PSTs) need science and social studies pedagogy for teaching at elementary schools, which often prioritize reading and math. Preliminary surveys showed that 78% of the PSTs (n = 290) felt science and social studies were the disciplines they were the least knowledgeable in and the least comfortable teaching, yet 92% felt "very comfortable" with literacy pedagogy. Therefore, methods instructors developed a multidisciplinary project, "Children's Literature for Science and Social Studies" (CLSSS). The purpose of CLSSS was to (a) connect content with literacy skills and (b) provide PSTs with "classroom-ready" resources. The CLSSS implementation resulted in feedback indicating that 87% of PSTs had a better understanding of multidisciplinary planning and teaching, and 83% were "very likely" to use these concepts in future instruction.

Keywords: literacy, science, social studies, elementary, cross-curricular

CHILDREN'S LITERATURE AS A VEHICLE FOR FOSTERING ELEMENTARY PRE-SERVICE TEACHERS' SCIENCE AND SOCIAL STUDIES ENGAGEMENT

Early-childhood and elementary pre-service teachers (PSTs) need the tools and skills to engage with science and social studies content successfully, deepen their understanding of essential concepts, and find ways to integrate these concepts into instructional schedules which often prioritize reading and math (National Council of Social Studies, 2018; National Science Teaching Association, 2012; NGSS Lead States, 2013). By designing dynamic, multidisciplinary literacy activities, PSTs experience the benefits of infusing literacy lessons with science and social studies content. Dynamic literacy activities encourage students' inquiry, critical thinking, and problem solving, which are essential skills at all grade levels (Cleovoulou & Beach, 2019). Today's PSTs are entering a school environment where cross-curricular cooperation is becoming the norm and an expectation; therefore, PSTs are expected to explore new avenues to deliver the curriculum.

Children's Literature in Instruction

For generations, storytelling and fiction have been learning tools that benefitted children in learning, memory, and imagination development (Walan, 2019). Furthermore, the use of storytelling and fiction has been deemed as indispensable in promoting a more interactive classroom (Moschovoki, Meadows, & Pelligrini, 2007). For example, Bishop and Kimball (2006) and Walan (2019) suggests that hands-on activities with fiction create a more engaging learning environment. Seda, Liguori, and Seda (2011) note that children's fiction can be a tool to engage students with their prior knowledge. Both Harrington (2016) and Straits and Nichols (2006) assert that using children's books can strengthen the learning of the curriculum, lead to meaningful classroom discussions, and reinforce students' in both reading for content and reading in general. Finally, Stewig (1992) asserts that the use of children's books can act as cultural bridges.

In the American elementary schools and pre-schools, the use of fiction and storytelling through children's books has long been a tradition in the English language arts and reading (ELAR) classroom (Boutte, Hopkins, & Waklatsi, 2008; Tschida, Ryan, & Ticknor, 2014). Furthermore, teacher preparation programs (TPPs) have long emphasized the use of fiction in their literacy and language arts methods courses (Kaywell, 2001). Conversely, studies have shown that the use of fiction and storytelling is less common in teacher preparation courses in social studies (Baker, Martin, & Pence, 2008; Falleman-Fattal, 2017) and science (Tschida, Ryan, & Ticknor, 2014). The result is that the use of fictional literature continues to be a relatively new and relatively unexplored practice in the elementary TPPs for science and social studies (Jewett, Johnson, Lowery, & Stiles, 2015; Tavares, 2017; Yi, 2014).

Literacy strategies that support science and social studies content for K-12 students can also effectively support PSTs. Research (e.g., Sackes, Trundle, & Flevares, 2009), provides concrete examples of science content aligned with children's literature. However, there is scant literature on effective strategies to engage PSTs in the process of choosing and developing lessons from children's literature. Further, available research focuses on linking a single discipline with a piece of children's literature. Our work differs in that we help PSTs develop a multidisciplinary

lens, based on more than one content area, through which they can view children's literature and practice thinking, planning, and teaching.

Literacy as a Tool for Content-Area Learning

PSTs need assistance in approaching reading with a critical stance aimed at "connective understandings" (Ortlieb & McDowell, 2016, p. 261). PSTs rarely approach reading with their own set of questions, engage themselves outside teacher-controlled discussions, or interact with spontaneous curricular exploration (Cox-Petersen & Spencer, 2006). Therefore, education PSTs in our program are encouraged to seek creative ways in which to approach different curricular areas. We encourage them to move away from the learning of fragmented facts and integrate the content into more real-life scenarios. In our TPP, literacy is the backbone of what makes our program so powerful. Students take a broad range of literacy courses (e.g., reading and writing workshop, children's and young adult literature, and language and word study) before beginning methods courses and field experiences. As a result, in both our science and social studies methods courses, great emphasis is placed on the power of reading as a transformative tool essential to a more vital and engaging learning process across and within all content areas.

It is important to note that while some scholars distinguish content-area literacy (Vacca, Vacca, & Mraz, 2010) from disciplinary literacy (Shanahan & Shanahan, 2008, 2012), both science and social studies rely heavily on the use of discipline-specific vocabulary (İlter, 2017). Ardasheva and Tretter (2017) note the "pressing need for all students to master the academic language and vocabulary" (p. 252), which includes content-specific technical terminology (e.g., "photosynthesis" or "apartheid"), non-technical vocabulary (e.g., "component" or "freedom"), procedural/signal vocabulary and general academic vocabulary (e.g., "the result of" or "the consequences of") (Ardasheva & Tretter, 2017; Harmon, Hedrick, & Wood, 2005; Taboada, 2012).

Our work bridges the theoretical gap between the two content-relevant types of literacy (Pohl & Miller, 2017; Allaire, 2018). The assignment we describe in this study espouses collaboration (Christou & Bullock, 2014) and a hybrid view of literacy across and within science and social studies instruction (Darn, 2009): the cross-curricular notion of integrating literacy into other contents while also exploring the inherent specialized literacies of those contents. PSTs apply those cross-curricular, content-area literacy skills such as summarization and vocabulary study. Yet, they also view the children's literature through the discipline-specific lenses of the historian and the scientist. This integration of the two approaches is more in keeping with the current literacy research, which refers to this distinction as a "false dichotomy" (Brozo, Moorman, Meyer, & Stewart, 2013, p. 353) and a misleading "bifurcation" (Dunkerly-Bean & Bean, 2016, p. 448).

The integration of literacy constructs mirrors the instructional collaborations that will best prepare our PSTs for society's multidisciplinary demands (Morrell, 2012). Social studies, ELAR, science, and math are no longer viewed as isolated categories of knowledge; teachers must seek linkages among the content areas (English language arts/reading, math, science, and social studies) through the integration of cross-curricular literacy skills (Christou & Bullock, 2014; Wright & Domke, 2019). As collaboration and cross-curricular teaching increase in prevalence,

educators will face and—hopefully—accept the challenge of a new era. Research supports the idea that teachers should be equipping their students with synthesis skills where disciplinary boundaries once existed (Moje, 2008; Pink, 2008; Rotherham & Willingham, 2010). Ultimately, discipline-specific expertise will enhance student preparation both across and within the content areas.

Relevant Educational Trends

In addition to the literacy-related aspects of our work, the assignment we implemented also reflects three more generalized trends in educational research (Pohl & Miller, 2017). First, Moje (2008) advocates for cross-curricular or horizontal multidisciplinary teaching, positing that it is more effective than the single-subject instruction that is characteristic of traditional school structures. Cross-curricular teaching promotes interactions that are both communal and collaborative (Christou & Bullock, 2014; Moje, 2008). Thematically aligned lessons, linked across all content areas, showcase this sort of collaboration (e.g., Steinberg, 1997; Wright & Domke, 2019). The new reality will be that teachers will someday eschew the isolation Morrell (2012) describes and seek out partnerships across departmental lines.

Another trend is the integration of alternative materials. Integrating materials from different areas, such as arts and entertainment, or current events into the instructional components of a particular subject encourages teachers to explore uncommon and perhaps unconventional pedagogical techniques (Miller, Scott, & McTigue, 2016). For example, ELAR classes commonly use movie clips to illustrate a concept, such as themes and motifs, but this practice is less common in a science class (Barnett & Kafka, 2007; Duncan-Andrade & Morrell, 2007; Ediger, 2012; Ritchie, Rigano, & Duane, 2008).

Finally, our work is situated within constructivist, student-centered approaches to instruction (Borg, Hewitt, & Lan. 2016; Kincheloe, 1997). More meaningful, individualized learning occurs when instruction is authentic and student-centered (Zhbanova, Rule, Montgomery, & Nielsen, 2010; Garcia, Mirra, Morrell, Martinez, & Scorza, 2015). Rather than continuing the use of traditional, isolating tools (e.g., lectures and worksheets), connecting, experience-oriented approaches to content delivery and assessment (e.g., portfolios and projects) are encouraged, as they reflect this constructivist approach. A student's education is enriched when previous knowledge is connected authentically to the outside world through problem-solving scenarios (Kincheloe, 2004; Garcia et al., 2015). Henning (2012) maintains that this more multidisciplinary and constructivist approach to instruction benefits students.

Engagement is a key component of this constructivist approach. To truly engage students is to motivate them to be involved in their quest for knowledge, acting as an agent that promotes the discovery of new information—a social endeavor that evokes curiosity and involvement (Guthrie, 1996). Additionally, this entails a series of complex behaviors (e.g., motivation, involvement, curiosity) where the student socially constructs his or her actions during the learning process. Engagement, therefore, is seen as the intentional process of encouraging a student-directed learning experience (Alexander, 2018).

The use of literacy strategies across and within disciplines creates a more engaged, student-centered, analytical instructional environment. In the current study, we investigated the integration of children's literature into the curriculum of methods courses in science and social studies in a TPP at an urban university in the southwestern United States. The research questions proposed in this study address how PSTs experience the use of non-traditional ways of teaching science and social studies from the perceived and accepted methods. In that sense, we depart from the traditional notion that science and social studies have to be taught and learned from dense, text-heavy, authoritative books that present irrefutable facts to be memorized. Also, high-stakes testing necessitates high proficiency in reading to cope with the learning of the material. Considering personal experiences and the building of these experiences, we wanted to explore how the use of age-appropriate reading material can encourage students to make more meaningful connections with science and social studies content and concepts.

METHODS

Beginning in the spring 2018 semester, science and social studies methods instructors have integrated a multidisciplinary assignment called "Children's Literature for Science and Social Studies" (CLSSS) into their respective elementary (PK-6) methods courses. The dual purpose of developing and integrating CLSSS was (a) to help PSTs make connections between science and social studies content and literacy skills, and (b) provide them with lessons, activities, and skills that were "classroom-ready."

Setting, Participants, and Course Context

The University is an urban, Hispanic-serving, and minority-serving institution in which Hispanic female PSTs make up the largest undergraduate student demographic as well as the demographic with the highest graduation rate. Approximately 40% of the University's undergraduate population self-identify as Hispanic or Latinx, and over 65% of Hispanic undergraduate PSTs are female (Data USA, 2016; University, 2017, 2018). The participating PSTs were all seeking early-childhood (EC) through sixth-grade certification, and their demographics mirrored the University's. The average age of the student participants was 27.2 years with an ethnic breakdown of 55% Hispanic, 36% Caucasian, and 9% African-American.

The participants are elementary school (EC-6) pre-service teachers enrolled in elementary science and social studies methods courses. Both the science and social studies methods courses are required components of PSTs' TPP at the University. They are both taken during the second of three field-experience semesters in the University's program. Science and social studies methods instructors focus their respective courses on providing PSTs with tools and skills to engage with science and social studies in a high-stakes testing world that emphasizes reading and math instruction (Berliner, 2011; Connor et al., 2017). As such, both methods courses are designed to actively involve PSTs to help them to be more comfortable and confident incorporating science and social studies content within the curricular limitations of their field experiences.

Elementary PSTs, like their in-service counterparts, are typically required to teach multiple subjects to a single group of students during their field experiences. However, PSTs do not feel

equally prepared to teach the various subjects. Before the project, a pre-assignment survey was administered. PSTs were asked to rate their level of comfort in teaching the different disciplines that comprise their certification exam (English Language Arts, Fine Arts, Mathematics, Science, and Social Studies). Students rated each discipline using a 4-point Likert-like scale (1 = not comfortable; 4 = very comfortable). The surveys were voluntary and had a 93% response rate.

Responses showed that 78% and 76% of the PSTs viewed science and social studies, respectively, as the disciplines they were the least comfortable teaching. Conversely, 92% of PSTs reported feeling "very comfortable" with teaching English Language Arts, specifically literature, literacy skills, and practices. These percentages align with the National Survey of Science and Mathematics Education (2013) in which 81% of elementary teachers of self-contained classes felt very well prepared to teach reading/language arts as compared to 47% and 39% for social studies and science, respectively.

Qualitative data, from reflections on multidisciplinary teaching, revealed PSTs lacked experience in methods of integrating different disciplines into cohesive lessons. As a result, a majority of PSTs noted they were unlikely to plan and teach multidisciplinary lessons. Similarly, many PSTs felt that some disciplines were more easily integrated (i.e., mathematics and science) than others.
Assignment Structure

The CLSSS assignment required PSTs to follow these steps: (a) select a grade-level appropriate children's literature book with relevance for both a science and social studies lesson; (b) record a "selfie-style" video reading the book; (c) write a review of the book; (d) develop a 7E-formatted science and social studies lesson plans; and (e) create a tri-fold poster displaying critical project components, including the QR code for the video's online location. In class, PSTs presented their work and participated in a "gallery walk," during which they offered critical and constructive feedback to their peers. To support this project and develop PSTs' ability to think and plan multidisciplinary lessons, class time in both methods courses was dedicated to reviewing different pieces of children's literature, discussing potential lessons, and practicing lesson planning.

First, CLSSS required PSTs to choose pieces of children's literature with relevance for both a science and social studies lesson across the same grade level. Given the demographics of the University and as members of an Urban Education TPP who were likely to teach in urban elementary schools, PSTs were encouraged, but not required, to choose culturally relevant literature for this project. Additionally, PSTs were reminded to refer to the characteristics of high-quality literature (as previously instructed in their literacy courses) in choosing well-written and well-illustrated books (Young et al., 2019).

Both instructors emphasized that PSTs were not to choose "science" or "social studies" books. Instead, PSTs were required to choose a general piece of children's literature. By doing this, PSTs could create lessons for multiple disciplines from the same book. This strategy moves PSTs away from the notion that separate reading books are required for each discipline. This approach encourages students towards a multidisciplinary philosophy in which the same book serves as the support for lessons across disciplines.

In addition to choosing general children's literature, PSTs were instructed against choosing overtly content-related trade books—books on a specific topic or person—written for children. For example, The Magic School Bus Lost in the Solar System (1990) by Joana Cole would not be an acceptable book for this project, whereas Regards to the Man in the Moon (2009) by Ezra Jack Keats would be appropriate. PSTs were encouraged to work with children's books they had previously used in their early childhood and elementary literacy courses, when reading to their students during field experiences, or even reading to their children.

PSTs used a template, agreed upon by the instructors (See Figure 1), to compose the book reviews. Each review included descriptive information about the book (e.g., title, author(s), publisher/year, and the number of pages). Instructors also required PSTs to research and include the readability statistics, grade-level interests, and the Lexile scores for their books. Finally, PSTs provided summaries of the books and brief explanations of why they chose their respective books.

Figure 1: An example of a book review completed by a PST for the book Last Stop on Market Street *by Matt De La Peña.*

CHILDREN'S LITERATURE REVIEW

BOOK INFORMATION			
Photo of Book Cover: 			
Book Title: LAST STOP ON MARKET STREET			
Author: Matt De La Pena			
Publisher/Year: G.P. Putnam's Sons Books, 2015			
Number of Pages: 32			
Readability Level: M		Interest Level: LG K-3rd	
Lexile Score: AD610L		Quality and Quantity of Illustrations: This book has a lot of illustrations with bright colors that catch the interest of little ones.	
Genre: Narrative Picture Book (Fiction)			
____ Expository	**_X_ Narrative (Picture Book)**	____ Narrative (Novel)	____ Poetry
Story Summary: Every Sunday after church, CJ and his grandma ride the bus across town. CJ wonders why they don't own a car like his friend Colby. Why doesn't he have an iPod like the boys on the bus? How come they always have to get off in the dirty part of town? Each question is met with an encouraging answer from Grandma, who helps him see the beauty and fun in their routine and the world around them.			
Why did you choose this book? I chose this book because I think this is a great book to get children thinking about the world around them and also all of the people that are a part of this world. I think this book can be used to help students explore the idea of what is important in life and about perspective. I also think this book has great illustrations.			

PSTs' lesson plans followed the 7E (elicit, engage, explore, explain, elaborate, extend, and evaluate) learning cycle (Eisenkraft, 2003; Miranda & Hermann, 2012) and were written using a second instructor-created template. The use of the 7E cycle gave PSTs the flexibility to determine where and how their chosen book fit best into their lessons. For example, some PSTs chose to use their book as an engagement activity for elementary students to stimulate interest, get them thinking about, and generate questions about a topic. In this way, the children's literature served as a starting point to other pedagogical approaches (i.e., experiments, inquiry, primary source documents) to teach their science and social studies lessons. On the other hand, some PSTs used their books as extensions of their science and social studies lessons to help elementary students make interdisciplinary connections.

In addition to the elements of the 7E cycle listed above, both the science and social studies lesson plans required PSTs to describe the specific content foci of their lessons, the learning standards, the lesson objectives, and any differentiation strategies that might be used to meet the needs of diverse learners. Written and verbal directions from the instructors specified that both the science and social studies lesson plans needed to meet state content-learning standards (Texas Essential Knowledge and Skills [TEKS]) aligned with the same grade level. Meaning, PSTs were not permitted to compose a first-grade science lesson plan and pair it with a fifth-grade social studies lesson plan. In this same vein, PSTs needed to ensure that their chosen books were age and grade-level appropriate for both lessons (see Table 1). For example, Regards to the Man in the Moon (2009) is appropriate for pre-school through second-grade. Therefore, PSTs science and social studies lessons, and state content standards, should also be for students within that grade range.

Table 1: Examples of PSTs' books and derived science and social studies concepts.

Grade Level(s)	Book Title	Author	Science Concepts	Social Studies Concepts
Kindergarten	*Where the Wild Things Are*	Maurice Sendak	Sort plants and animals into groups based on physical characteristics (color, size, body covering)	Physical (landforms, bodies of water, natural resources, and weather) and human characteristics (ways of earning a living, shelter, clothing, food, and activities) of place
1st Grade	*Hairs - Pelitos*	Sandra Cisneros	Identifying and explaining a problem and proposing and solution, making predictions based on observable patterns, describing what scientists do	Understanding ethnic and/or cultural celebrations; identifying the significance of various ethnic and/or cultural celebrations
3rd Grade	*Tar Beach*	Faith Ringgold	Observing, recognizing, describing, and	Using simple geographic tools

			recording patterns of objects in the sky, including the appearance of the moon	(maps and globes); creating maps to show places and routes within the home, school, and community
5th Grade	*The Owl Goes on Holiday*	Ulf Stark	Relationships, systems, and cycles within the environment; the flow of energy in a food web including the roles of producers, consumers, and decomposers	Using geographic tools (grid systems, legends, symbols, scales, and compass roses) to collect, analyze, and interpret data; constructing and interpreting maps

In addition to the book review and lesson plans, PSTs made selfie-style digital recordings of themselves reading their books. PSTs uploaded the recordings to YouTube and created QR codes that enabled individuals to watch the videos from their smartphones or tablets. Two factors informed the incorporation of a selfie-style video of PSTs reading their books. First, teacher-led readings are common occurrences in elementary classrooms, and watching themselves conduct a read-aloud allows PSTs to critically analyze and reflect upon their performance of a common literacy-based practice. In particular, PSTs are instructed to pay attention to how they make eye contact, the tone of their voice as they read, the wait time they give to look at the pictures in a book, and their facial expressions throughout the reading.

Second, the instructors understood that online video platforms, such as TeacherTube and YouTube, can be powerful educational tools for both extending learning beyond the classroom as well as addressing the needs of diverse learners. While gaps do exist, smartphones, tablets, and personal computers are almost ubiquitous. Digital recordings of teachers reading books posted online allow PSTs to watch and listen to a story multiple times within their classroom settings. Additionally, digital video platforms have built-in closed captioning, translations, and methods of changing the speed of the video to accommodate the needs of diverse learners. In order to protect the copyright of the authors, student videos were not made public and were available online only for the in-class gallery walk.

The book reviews, lesson plans, and videos served as standalone formative assessments and were then incorporated into the final assessment project: the “fair-style” trifold boards (see Figures 2 and 3). The center panel of each board contained book-specific information, such as the title, a picture of the cover, and the book review. Specified elements of their science and social studies lessons were located on the left and right panels, respectively. Trifold boards were brought to class on the due date and set up for the gallery walk described in the next section.

Figure 2: The template PSTs used to compose the Trifold Board for CLSSS.

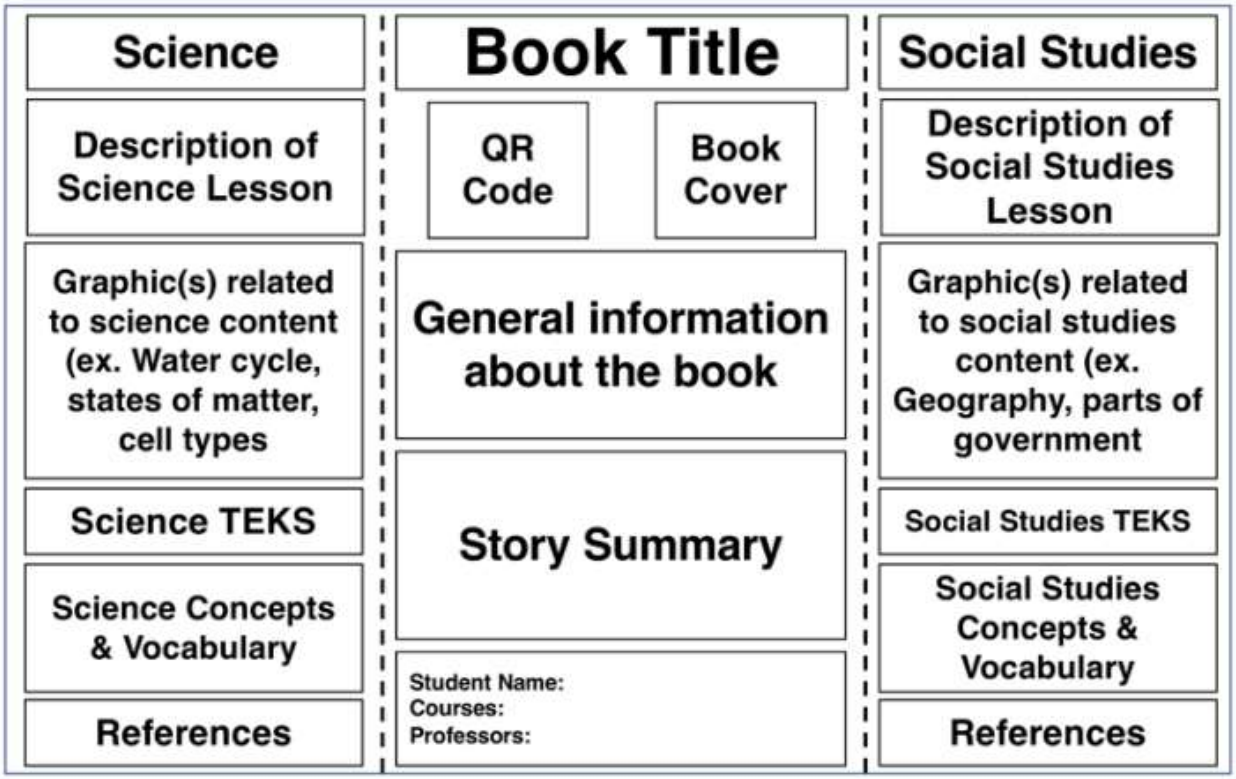
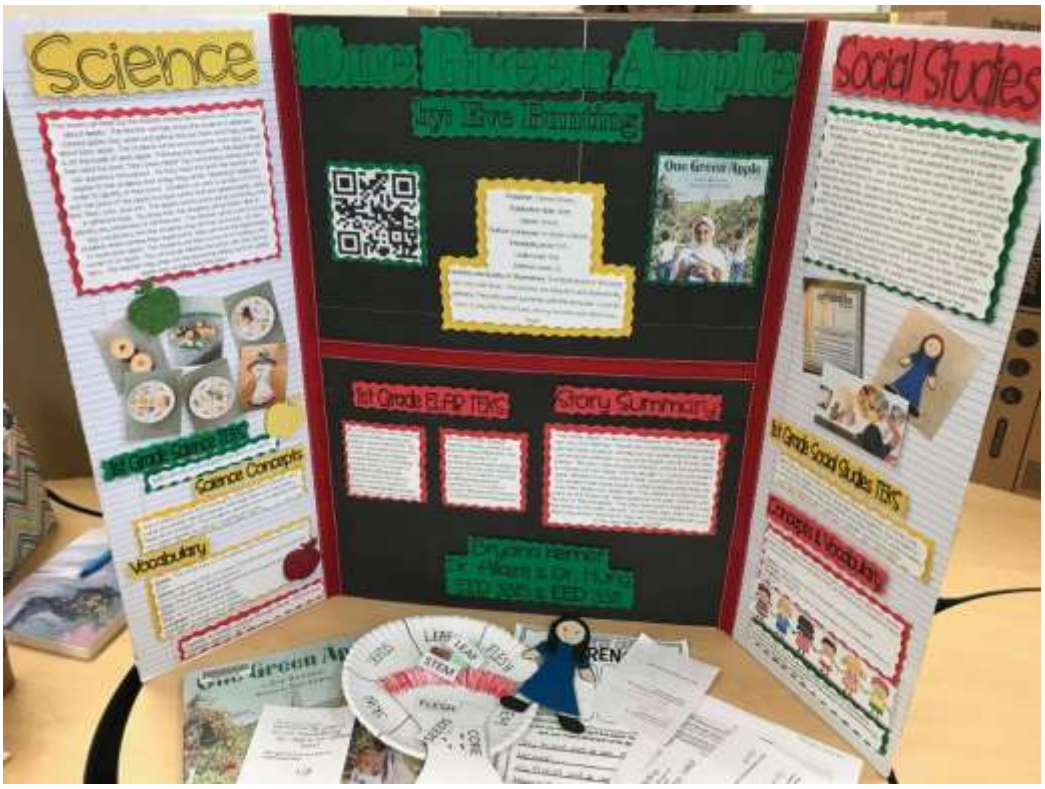


Figure 3: A PST's finished poster board for the book One Green Apple *by Eve Bunting.*

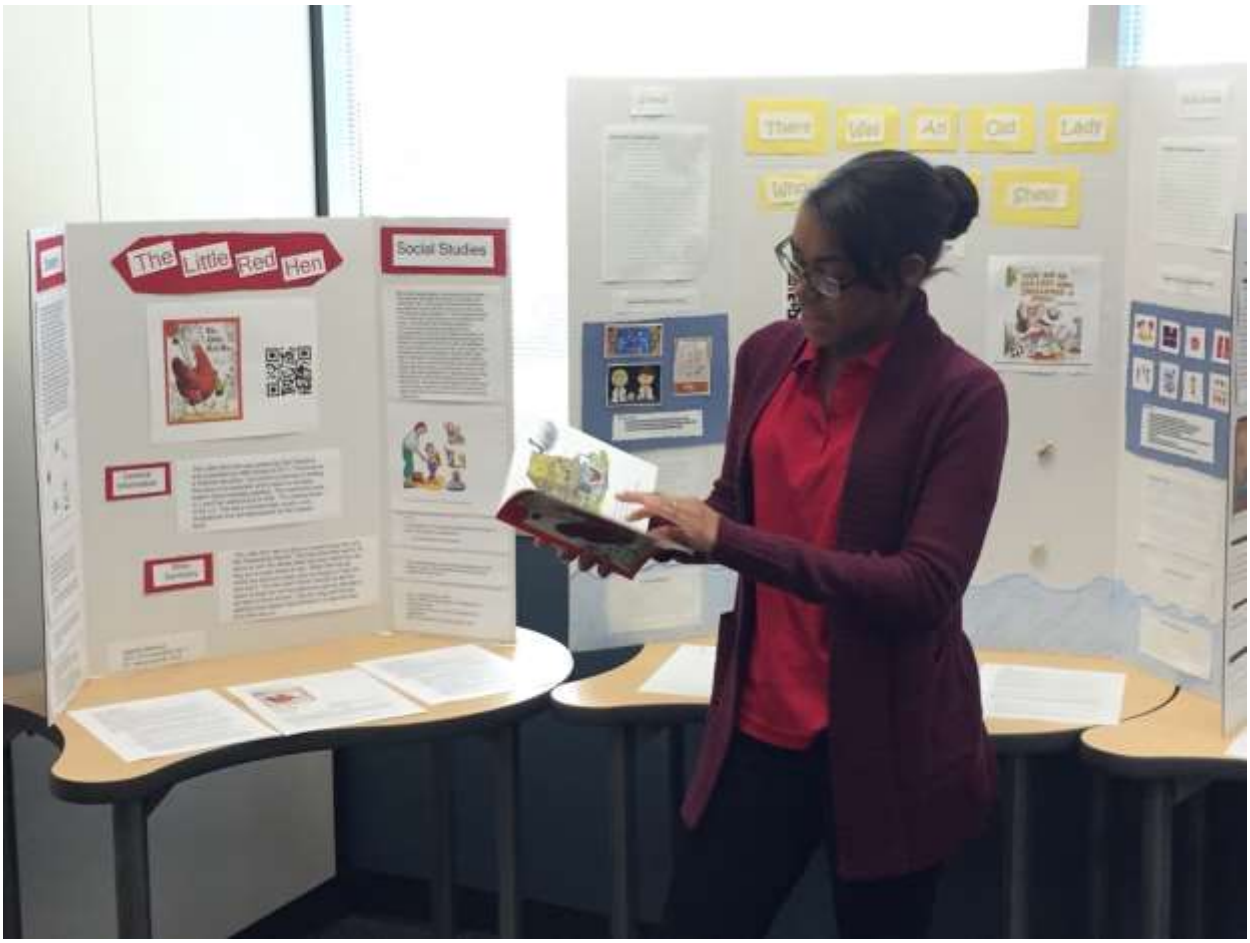


Final Presentation and Gallery Walk

As explained previously, PSTs were required to bring hard copies of their book reviews and lesson plans in addition to their trifold boards. On the due date, PSTs brought their completed trifold boards and a copy of their books to a joint meeting of their science and social studies methods classes. They participated in presentations and a gallery walk of their work, a process similar to poster presentations at an academic conference. PSTs' tri-fold boards were set up in a circle around the perimeter.

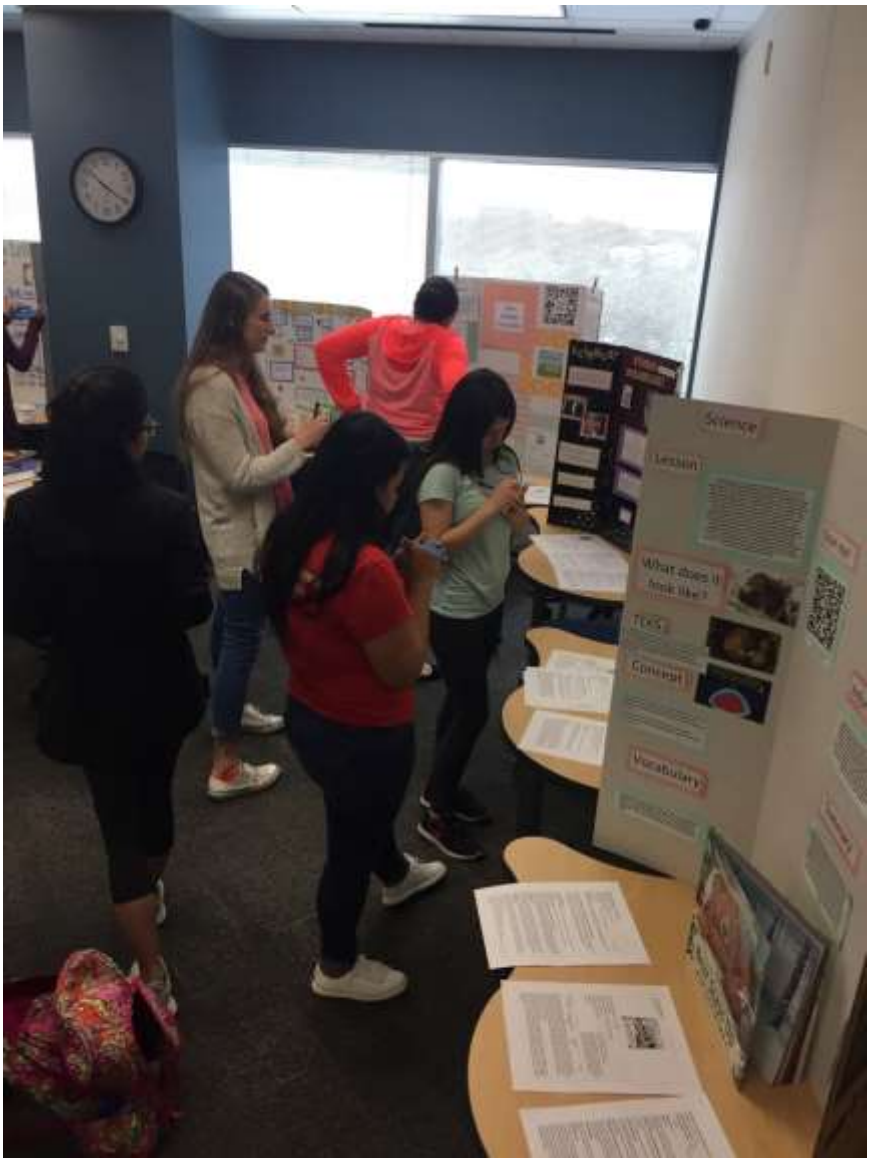
After a brief introduction by both instructors, PSTs individually presented their tri-fold posters and books to the class (see Figure 4). During their presentations, PSTs gave synopses of their books, brief explanations of why they chose their books, and summaries of both their science and social studies lesson plans.

Figure 4: A PST presents to her class about the book The Little Red Hen. During presentations, PSTs summarized their books and gave overviews of both their science and social studies lessons.



Following the presentations, PSTs performed a gallery walk—an opportunity to view each other's work up close and in more detail (See Figure 5). Instructors provided sticky notes to the PSTs and directed them to leave feedback for their peers on the backs of the tri-fold boards. Three guidelines were given to PSTs to encourage useful comments and feedback: 1) comment on specific aspects of the tri-fold board or lesson plans that they liked, 2) ask questions about parts of the tri-fold board or lesson plan they did not understand, and 3) make specific recommendations for improvement. Overall, PSTs were encouraged to be both supportive and critical; most importantly, PSTs were told to be specific.

Figure 5: After presentations, PSTs performed a Gallery Walk during which they had the opportunity to view their peers' trifold boards and full lesson plans. PSTs were given a stack of notes on which they were encouraged to provide positive and critical feedback to their peers.



Post-Assignment Survey

Since this type of cross-discipline project is not common in the TPP, the instructors were interested in gathering student feedback about the experience. A voluntary survey was administered digitally as an exit pass on the day of the project presentations and gallery walk. The survey consisted of four open-ended questions:
1. What did you like most about this assignment? Why?
2. What did you like least about this assignment? Why?
3. What "a-ha" moments did you have when doing this assignment?
4. What are the main takeaways from this assignment that you could use during your student teaching and professional teaching?

In addition to the open-ended questions, the survey also asked PSTs to rate the overall assignment and the likelihood that they will use cross-curricular concepts found in this

assignment in their future classrooms using a 4-point Likert-like scale (1 = very unlikely; 4 = very likely).

RESULTS

While both the PSTs and the instructors were initially uncertain as to the success of the assignment, all of the enrolled PSTs successfully created two lesson plans—one for science and one for social studies—using the same piece of children's literature. Additionally, PSTs permitted the instructors to share their lesson plans with the entire class. As a result, each student received a digital version of the complete set of science and social studies lesson plans generated for this project in the particular semester. At the time of the final presentations, several PSTs verbalized that the student-generated 7E lesson plans would be useful the following semester during student teaching and when they begin their careers as in-service teachers.

Results from the voluntary digital survey, to which there was a 100% response rate, also pointed to PSTs having an overwhelmingly positive experience with CLSSS. The average rating for the assignment was 3.8 on a 4-point scale. Responses to the open-ended question on what they liked the most about the CLSSS assignment echoed this rating. PSTs' comments indicated that they found the opportunity to bring science, social studies, and reading together was fun and useful.

"While helpful, our classes never really connect with each other. This project [CLSSS] was the first project that linked teacher prep courses together."

"I used a book from one of my literacy courses. So this project built on what we covered in our literacy courses and connected it to science and social studies. Why can't all of our courses and projects do this?"

"Using the same book as a starting point for multiple subjects makes [the book] so much more powerful as a teaching tool and meaningful for the students."

"This project was an awakening. Not only can I use the same book for science and social studies, I also figured out mathematics and fine arts lessons, too! I can cover so many topics from just one book!"

PSTs especially appreciated choosing their books, many of whom chose books they had worked with in previous literacy courses or with their mentor teachers, as opposed to being assigned a book by an instructor. Viewing each other's work during the gallery walk received positive comments as well, with many PSTs valuing the positive as well as critical feedback from their peers.

The most challenging aspect, according to the PSTs, was finding a book that worked for both science and social studies—two subjects, several noted, that are not typically interconnected. For most PSTs, finding a high-quality book that was viable for both science and social studies was an "a-ha" moment in the project. The discovery of a compatible book, coupled with the realization that they could create lessons for science and social studies, subjects some PSTs considered to be their weakest areas was a powerful pedagogical moment.

PSTs' most significant criticism of the project has been the integration of the digital video. Despite understanding the purpose and potential of the selfie-style video, PSTs reported feeling awkward about recording themselves reading and even more awkward watching themselves on camera. However, the instructors included this component intentionally, as the edTPA includes a video performance task, and researchers recommend using video-based assignments in teacher education courses (Huston, 2017; Falter & Barnes, 2020).

Throughout the planning and execution of CLSSS, the instructors hoped the main takeaway would be an increase in both the PSTs' confidence in the implementation of literacy strategies into other content areas and the likelihood of incorporating such strategies into their teaching practice. Survey responses revealed that PSTs met the instructors' objectives and that PSTs saw the potential of using intra- and inter-disciplinary literacy strategies. Eighty-seven percent of respondents felt that they were "very likely" to use the cross-curricular concepts found in this assignment in their classrooms. PSTs explained that thematic learning—specifically using children's literature—could be beneficial to "hooking" PSTs, holding their attention through multiple content lessons, and creating meaningful links across disciplines. Several felt this was crucial, given that "not a lot of time is dedicated to [science and social studies] during the school day, so it's important to know that they can be incorporated into other areas such as reading," an observation supported by research (Berliner, 2011; Connor et al., 2017). When reflecting on multidisciplinary lesson planning and teaching, many PSTs made a financial connection: "It's a given that teachers are going to purchase materials for their classrooms. By using the same book for multiple lessons, I can get more bang for my buck!" Finally, PSTs saw this as an opportunity to explore their creativity and to build their classroom libraries more efficiently.

DISCUSSION

As evidenced by the pre-survey, the PSTs' perceptions of science and social studies instruction often hamper their comfort levels in teaching those contents. The experience of CLSSS creates valuable opportunities for PSTs to both create and participate in dynamic, cross-curricular lessons that (a) deepen their understandings of concepts in both these content areas; (b) support the hybrid view of literacy across and within the disciplines; and (c) reveal a flexible approach to incorporating literacy growth within content-area instruction. CLSSS takes up the challenge Henning (2012) gives us regarding the benefits for implementing multidisciplinary lessons by adopting an alternative instructional material in a meaningful way and espousing a constructivist, student-centered approach for more authentic teaching. These approaches, and CLSSS specifically, generate a better connection to previously learned knowledge by providing real-life scenarios, promoting better opportunities to use problem-solving skills, creating genuine learning spaces, and enriching the PSTs' TPP experience (Kincheloe, 2004; Garcia et al., 2015).

Cross-Curriculum or Horizontal Multidisciplinary Teaching

The new reality is that teachers and content areas alike no longer operate in distinct, isolated silos. Partnerships and collaborations across departments and subject areas are becoming the norm across the country (Parker, Heywood & Jolley, 2012). Although challenging to implement within traditional school structures, cross-curricular, or horizontal multidisciplinary, teaching is

necessary to promote communal, collaborative interactions across subject areas (Moje, 2008; Wright & Domke, 2019). Structurally, the methods courses in TPPs reflect this traditional compartmentalization; thus, cross-curricular projects are challenging to model and implement in university settings as well (Pink, 2008; Rotherham & Willingham, 2010).

As such, the CLSSS project is successful on multiple fronts. CLSSS creates an enactive mastery experience (Bandura, 1997) in which PSTs engage in age and grade-appropriate cross-curricular lesson planning process clustered around a central theme (children's literature). One student reflected that "thematic learning…allows me to be more creative as a teacher." This process also helps PSTs create links between seemingly disparate content areas (Christou & Bullock, 2014; Darn, 2009). Another student noted these links: "When we were assigned this project, I immediately thought that connecting science and social studies would be fairly difficult. When I came across a book about the Statue of Liberty, I thought 'a-ha'! Here's a history lesson, and she's green because of science!" Through CLSSS, methods course instructors are also able to effectively model the cooperative planning process needed to integrate cross-curricular projects into multiple content-related courses successfully. As a result, PSTs who have engaged in CLSSS should be more successful in creating a professional environment, which fosters communication, collaboration, and cooperation between ELAR, science, and social studies teachers, by facilitating cooperative lesson planning clustered around a central theme (Steinberg 1997).

Integration of Alternative Materials

Just as there is a movement toward cross-curricular teaching, there is a movement away from so-called traditional materials (e.g., textbooks and worksheets) in both TPPs and K-12 classrooms for a more creative use of alternative sources (Barnett & Kafka, 2007; Duncan-Andrade & Morrell, 2007; Ediger, 2012; Ritchie, Rigano, & Duane, 2008). The integration of alternative materials as instructional components of methods courses encourages PSTs to explore pedagogical techniques not commonly used in their particular subject (Scott & Miller, 2016). As CLSSS exhibits, materials that are traditional in some settings can be viewed as alternative in others; thus, it is just as much the function as it is the materials themselves that can challenge traditional approaches.

Through CLSSS, PSTs realized that children's literature could be a fun and effective alternative material to facilitate lessons in both science and social studies. PSTs noted this realization as one of the "a-ha" moments of the project:

"You can take almost any book and turn it into any kind of lesson."

"There are many ways to use one book to teach different subjects."

"We don't have to use the entire book to create a lesson. A single page could have a teachable moment and material."

In addition to enhancing the pedagogical and instructional approaches PSTs can use in the classroom, CLSSS also supported their science and social studies self-efficacy. Studies show that

a lack of confidence in teachers' abilities to teach impacts the quality and quantity of content-area instruction (e.g., Holtzberger, Philipp, & Kunter, 2013; Morris, Usher, & Chen, 2017; Usher & Pajares, 2008). The use of children's literature as an alternative material supports and builds PSTs' teaching self-efficacy. PSTs participating in CLSSS made positive and meaningful connections between content in which the high levels of self-efficacy (ELAR; children's literature) and low levels of self-efficacy (science and social studies). Huinker and Madison (1997) explain that "the more positive the impact on pre-service elementary teachers' efficacy during their teacher preparation programs, the more likely it is that these individuals will engage in effective teaching behaviors in the future" (p. 109). Thus, CLSSS has the potential to help PSTs feel more comfortable and confident when teaching science and social studies.

Constructivist Approaches

The CLSSS project is an opportunity for teacher educators to demonstrate and PSTs to participate in a constructivist, student-centered approach to teaching (Kincheloe, 1997). Increasingly, teachers and teacher educators are moving away from the traditional lecture, worksheet, homework, and end-of-unit exam format. Instead, semester portfolios, end-of-course projects, student presentations, and other experience-oriented assignments are generating more authentic forms of hands-on and student-centered instruction, along with the possibility for more meaningful, genuine, and personal kinds of learning (Zhbanova, Rule, Montgomery, & Nielsen, 2010; Garcia, Mirra, Morrell, Martinez, & Scorza, 2015). For teacher educators, CLSSS is an opportunity to model a constructivist, student-centered instruction and demonstrate how theory translates into practice. For PSTs, CLSSS is an opportunity to engage in a practical, experience-oriented assignment based on a piece of children's literature in which they are genuinely interested. Additionally, the end product is the development of two "classroom-ready" lessons and activities.

Transforming the Typical

It has been said that "practice makes perfect." However, elementary PSTs are not afforded many opportunities to practice teaching science or social studies content. Science and social studies methods courses instruct PSTs in content-rich strategies to explicitly teach both disciplines. However, several factors impact pre- and in-service elementary teachers' ability to implement these strategies and teach standalone science and social studies lessons. These factors include the socioeconomic status of children served by a school, the school budget, a teachers' science or social studies self-efficacy, and years of experience (Piasta, Pelatti, & Miller, 2014; Sackes, Trundle, & Flevares, 2009). There is also administrative pressure on teachers to focus on reading, writing, and mathematics due to high-stakes testing (Berliner, 2011; Connor et al., 2017).

Unfortunately, these challenges do not seem to be abating in the foreseeable future. As such, teacher educators must provide tools and methods for PSTs to "sneak" science or social studies content into the elementary grade-level classroom. Anecdotal evidence provided by PSTs revealed their mentor teachers rarely taught standalone science or social studies lessons. Some PSTs shared that teaching science and social studies was actively discouraged by administrators in favor of reading, writing and mathematics – disciplines being tested at the elementary grade

levels. While not ideal, the authors believe that "sneaking" science and social studies content into the elementary curriculum is more preferable than not being included in any way, shape, or form. A positive move in this direction is seen in the increasing presence of literacy skills in content-area standards (Wright & Domke, 2019).

TPPs that provide methods courses in isolation do not prepare elementary PSTs for the multidisciplinary demands of the 21st century (Morrell, 2012); thus, CPSSS enables our PSTs to confront and ultimately embrace the challenge of a new era when collaboration and cross-curricular teaching will be the norm. Our research emerges as a response to the current literature about children literature on science and social studies that only recommends specific books along with prescribed lesson activities, but do not provide ideas for PSTs to explore and create their own multi-disciplinary curriculum (Pohl & Beaudry, 2015). Moreover, as the demands to better prepare our PSTs increase, the disciplinary-specific literacies of ELAR, science, and social studies can enhance PSTs' developing expertise in these areas. Teacher educators, as models, should seek to collaborate more closely to equip PSTs with the synthesis skills they will need to succeed in the future (Pink, 2008; Rotherham & Willingham, 2010).

CONCLUSION

The CLSSS project was designed to teach elementary PSTs the benefits of cross-curricular cooperation, innovative use of alternative materials, and approaches to constructivist teaching in science and social studies. Additionally, the project exposed PSTs to new techniques on how to use ELAR content and help them to integrate this content at the micro and macro level in their lesson planning. This project was developed to empower PSTs to work together across different curriculums to find common themes and teaching goals. Preliminary experiences in piloting this project suggest that PSTs who took part in CLSSS develop a broader approach to teaching across subjects, tend to think more outside the proverbial box, and develop better confidence when taking new initiatives. This assignment helped PSTs understand the dynamics of cross-curricular collaboration not as a noble, theoretical ideal but as a doable, authentic experience.

It is well understood that innovative pedagogical instruction strengthens best practices in teacher education. The authors firmly believe that this project was very beneficial for the teacher candidates, and, to fulfill the mission to create an engaging learning environment, it is essential for teacher candidates to understand new and more innovative practices that will enhance the learning lives of the student and teacher. This new understanding includes cross-department and cross-curricular collaboration, the use of alternative instructional materials, and constructivist lesson instruction. The CLSSS project provided student teachers and authors the opportunity to work together in providing the next generation of teachers with more efficient and multi-faceted teaching tools for their future careers.

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SHIFTING TO AN OUTDOOR LEARNING SPACE: Embracing Nature to Support Science Process Skills for English Learners

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ABSTRACT

Technology has assumed an emerging role that has shifted educators' and adults' perceptions of childhood learning and education. As technology continues to develop and its importance is regarded on a daily basis as facilitating the lives of our global communities, children are becoming impacted and their outdoor experiences are starkly different than almost a decade ago. Due to an increase in the integration of technology in every aspect of life, the opportunities to learn science for English Learners (ELs) in an outdoor classroom environment has decreased (Davis, Harris, & Cunningham, 2019). Students are disconnecting from the understanding that nature exists in their own backyards and neighborhoods, which can further the detachment from science literacy and an appreciation of the natural world. However, nature is a strong motivator for students', particularly ELs, and is attributed to the development in their cognitive levels for reaching abstract reasoning in science (Meier & Sisk-Hilton, 2017). In this article, the authors provide a strong rationale for supporting innovative science practices using nature as a vehicle and the outdoor classroom as a context for learning and applying the science process skills. Best practices are presented for Early ELs and are supported as ways to support ELs' engagement and interests in science education.

SHIFTING TO AN OUTDOOR LEARNING SPACE: Embracing Nature to Support Science Process Skills for English Learners

Early English Learners (ELs) in a dual language kindergarten classroom were excited to communicate about the leaves they collected last evening from their backyards. At school the following day, the leaves became accessible in the discovery station, where they were going to engage in an observation activity of comparing and contrasting the colors, shapes, and sizes of their leaves. Vygotsky (1936) found that learners need to put words to their observations and for science educators of Early English Learners those observations become "spring boards" for science inquiry and science literacy.

Figure 1. Students' leaves

Introduction

In the opening vignette, the excitement of students is apparent in a kindergarten dual language classroom who studied the topic of *seasons* by observing the differences that occur in nature by examining the leaves they collected from their own backyards. However, as technology continues to develop and its importance is regarded on a daily basis as facilitating the lives of our global communities, students are becoming impacted and their outdoor experiences are starkly different than almost a decade ago. Students are seemingly becoming disconnected from the outdoor world of nature and their experiences are predominantly mediated using technology and media, where a virtual space is replacing the outdoors, particularly the outdoor classroom. Due to these factors, such as innovative technology accessible to many and an increasing need for communication, the culture of childhood is being shaped in dramatically different ways. Children who often played outside in the past have diminished and everyday life has shifted children's play to the indoors (Hart 1999, Moore, 2004). The outcome of this new learning practice has resulted in a fading opportunity for children to connect with the experiences of nature (Chawla, 1994, Kellert, 2002, Kuo, 2003, Pyle, 2002, Rivkin, 1990, & Wilson 1996). Francis (1991) refers to the loss of children's experiential play in nature as a childhood of imprisonment. Children are disconnecting from the understanding that nature exists in their own backyards and neighborhoods, which can further the detachment from science literacy and an appreciation of the natural world (Maltese & Tai, 2010). In this article, the authors provide a strong rationale for supporting the outdoor classroom as a space where natural experiences for Early ELs are positively associated with developing imagination and a sense of curiosity and inquiry (Cobb, 1977 & Louv, 1991). In order to facilitate these early science experiences, the science process skills are explored for their applicability in nature and the outdoor science classroom.

English Learners (ELs) and Science Education

Linguistic diversity has rapidly increased in every part of the country and in every EC-12 grade. Research has indicated that more than 5.5 million or 11% of public school students are categorized as ELs (National Center for Education on Statistics, 2006). ELs are "students whose first primary and native language is not English and who are learning English at school" (Diaz-Rico, 2012, pg. 1). Building upon this definition, Early ELs are defined in this article as children who participate in early childhood settings and whose native language is not English. In the classroom, early ELs should be provided the opportunity for science inquiry that facilitates the construction of an EL's own knowledge as teachers facilitate and guide the science investigations. Instructional strategies can support an EL's understanding for science inquiry because teachers are allowed to customize and scaffold learning experiences connected to language development. In addition, ELs and their monolingual English speaking peers are immersed in the English language however, require special linguistic accommodations to make the instruction comprehensible and meaningful (August & Shanahan, 2010). Additionally, structured guided inquiry that builds on students' prior knowledge provides ELs with opportunities to learn science before moving on to a more open-ended approach to learning science (Amaral, Garrison, & Klentschy, 2002; Warren & Rosenbery, 2008). In conjunction with structured guided inquiry, an effective science inquiry approach is best implemented when real life materials (see Figure 1.) are provided to create authentic experiences that support ELs as they observe and interact within a scientific content and its processes. ELs also flourish in these authentic learning opportunities where a risk-free learning environment is provided and they are allowed to explore and investigate science (Huerta & Jackson, 2010).

However, international and national studies on science achievement have indicated poor science performance of U.S. students overall, and persistent achievement gaps between monolingual English speakers and ELs within the United States remain (Campbell, Hombo, & Mazzeo, 2000; National Center for Education Statistics, 1996; Schmidt, McKnight & Raizen, 1997). The negative impact of educational policies affecting science education, starkly contrasting the aforementioned approaches and practices, tend to have a greater effect for ELs. For example, states requiring accountability in literacy and mathematics prompt and encourage teachers to neglect other content areas such as science and social studies and increase the pressure for accountability in reading and math which overshadows the concern for ELs' learning opportunities in science (Lee, 1999; Lee & Avalos, 2002). One of these critical science learning opportunities is access to experiences engaging in science inquiry-based instruction.

Science Inquiry Based Instruction

The science inquiry-based learning approach involves the process of exploring the natural or material world. Such an approach leads to asking questions, making discoveries, rigorously testing hypotheses, and explaining discoveries in the search of knowledge (Mullis, Martin, Ruddock, O'Sullivan & Preuschoff, 2009). Inquiry-based instruction is a powerful pedagogical, student-driven tool implemented across all levels of education (Kahn & O'Rourke, 2004). According to Victor and Kellough (2011), inquiry-based strategies develop mental skills critical for problem solving. They also found that students, who interact with the natural environment through observation of organisms, classification of matter, and measurement of objects had a better understanding of science concepts than students taught in a traditional classroom setting.

Savas, Senemoglu, and Kocabas (2012) discussed that outdoor classroom instruction using inquiry-based instructional activities supported science literacy, language development, and academic achievement. The integration of students' outdoor experiences into the adopted curriculum also benefited students' English language skills (Auer, 2008). Gega (1994) expressed that when students plan and draw a large picture to illustrate conservation, practice drawing parts of a plant, or make a diagram of the water cycle, they are creating art from two reference points. The reference points can be from memory recall or from observation. Gega (1994) further indicated that integration of science content and language arts during indoor or outdoor classroom science laboratories can be advantageous for ELs. Thus, inquiry-based instruction in an outdoor classroom setting helps ELs develop a better understanding of different science concepts, and from a more natural perspective. Victor and Kellough (2011) also described that ELs, who work in outdoor settings, create a vision of common things in the environment, helping them synthesize and evaluate science concepts about the world around them. Teachers in public and private schools use inquiry-based learning in an outdoor classroom setting as an educational tool to improve ELs' academic language in the area of science. Coupled with this sense of independence facilitated by science inquiry in an outdoor context, the use of the science process skills in tandem can engage ELs successfully in science inquiry.

Science Process Skills

Padilla (1990) introduced the science process skills as a way to provide teachers with a focus on defining and conceptualizing the science processes as key methods to engaging in scientific inquiry that would lead to a deeper understanding of a scientific concept or topic. This deep understanding is an important goal for educators to ensure scientific thinking, inquiry, and reasoning for their students. Table 1 demonstrates the application of the science process skills to the study rocks, as an example, using observation, measurement, classifying, communicating, inference, and prediction in a classroom.

Table 1: Basic Science Process Skills

Basic Science Process Skills
Observation - the senses to gather information about an object or event. Example: Describing a rock.
Measurement - assigning numbers to objects or events that are arranged according to a set of values. Example: Measuring a rock with a ruler or using a non-standard form of measurement such as math manipulative cubes.
Classifying - grouping or ordering objects or events into categories based on properties or criteria. Example: Placing all rocks having certain grain size or hardness into one group.
Communicating- using words or graphic symbols to describe an action, object or event. Example: Describing how the rocks change its form from weathering.

Inference - making an "educated guess" about an object or event based on previously gathered data. Example: Saying that the rock could be used as a writing tool because it was used as chalk.
Prediction - stating the outcome of a future event based on a pattern of evidence. Example: Predicting the rock will break into smaller pieces is based on using the rock as a writing tool.

Intentional Ways to Use Science Learning to Counter a Nature Deficit

Science education has aimed to identify content standards supported by the National Generation of Science Standards (NGSS) that encourage best practices for culturally linguistically and diverse students (NGSS, 2013). However, there is still a need to provide further understanding about effective pedagogical methods and strategies that prompt students to engage in science learning in the context of the outdoor classroom. Moreover, the outdoors can provide a space to counter the increasing problem of a nature deficit among early learners. Nature deficit disorder was coined by Richard Louv (2005), who conceptualized when children have less and less interactions with nature this affects their physiological and psychological well-being, which he identifies as part of the richness of the human experience thus, leading to a narrower perspective.

The most exciting aspect of education in outdoor classrooms is the enthusiasm children demonstrate for learning in nature. In outdoor classrooms, children are intentionally guided to explore and discover nature that prompts children's inquiry of science concepts and allows children to be 'children' while discoveries unfold. The natural world inspires children to experience the intrigue and establish a purpose for science learning in which they will want to explore, investigate and develop new skills and interests as a result of these activities. Through the exploration and investigation, students can also enhance academic achievement and scientific literacy in experiencing learning in the outdoor classroom (Malone, 2007). Learning in the natural world is a beneficial teaching tool and grounds learning in observable facts connected to students' lived experiences (Smith, 2002).

Nature is also an essential part of our everyday lives, however, it is in jeopardy if viewed as insignificant for student learning and can prompt a movement towards a nature deficit among young children. Therefore, teachers of Early ELs have to be intentional when they are developing their lessons and activities. Such intentionality can assist teachers to develop different ways to address and emphasize important scientific concepts and thinking. As a result of this intentionality, children can also be grouped to encourage social interaction, engage in sensory exploration, and be provided tasks to serve as stimulus for science inquiry, all occurring in an accessible and equitable nature environment.

According to Minner, Levy, and Century (2010), indoor and outdoor field experiences offer countless opportunities for ELs to participate in hands-on activities and oral language development. An outdoor classroom setting using inquiry-based instructional activities helps create a learning environment. This learning environment helps ELs develop a better understanding of different science concepts from a natural perspective. Friere (1970) explained

that in a classroom setting where inquiry-based learning takes place, ELs have the opportunity to interact with their peers, as the teacher assumes the role of facilitator of knowledge.

Therefore, in this article, we provide classroom examples in using nature as an exploration of Early ELs engaging in science activities while learning to apply the science process skills as a mode for scientific learning. For Early ELs, Selly (2017) found that "The fundamental process skills and habits of mind that early childhood [science]…learning supports go hand in hand with the ideas and outcomes of nature-based learning and natural settings in early childhood" (p.21). In the following sections, we will learn how teachers provided essential opportunities in nature that supported ELs' scientific learning while attending to the implementation of the science process skills and theories of language for Early ELs**.**

Science Classrooms as Contexts for Intentionality

Even though schools provide contexts for learning science in classrooms and laboratories, the outdoor environment as a classroom also serves a strong purpose in developing an ecological framework towards learning science. In this article, two early childhood sites in the southernmost part of the US provided the context for understanding how Early ELs can flourish in an outdoor environment for learning science. The following are intentional and strategic ways to address the nature deficit aggressively affecting todays' youth and provides through the teachers' practices, lessons and activities an understanding of how to utilize our natural resources to motivate and inspire Early ELs' notions of science inquiry while promoting language development.

The first context is a kindergarten dual language classroom where students are engaged daily in developing their bilingualism, biliteracy and biculturalism throughout the school day. The classroom makeup included 10 girls and 6 boys. All students participating in this one-way dual language classroom were Latinx and were at different proficiencies in their first and second language. The majority of the class, more than 50%, was learning English as their second language and all students were developing their academic Spanish proficiency. The kindergarten teacher in this classroom, who we will identify as Ms. Gomez, is also Latinx and has four years teaching experience in a dual language program.

The second context was Marshall Early Learning Center where students ranged from 3 years of age to 4 years of age. All the students were culturally and linguistically diverse, from Latinx and African-American backgrounds. The early learning center consisted of Pre-Kindergarten programs for 3 year olds and 4 year olds. Each grade level consisted of 5 teachers and all were participating in the schools initiative to integrate nature as part of their daily science curriculum. All the teachers at Marshall had between 2 years to 20 years teaching experience. Therefore, to understand the practices of all the teachers, science lessons integrating the use of nature were observed.

The following are best practices that were observed as intentional approaches to promote science inquiry using nature as a stimulus for discovery and exploration. The examples presented were gathered from observations in nature as the outdoor classroom, interactions between teachers and students in the indoor and outdoor classroom, teacher coaching conferences, after school meetings and observer field notes.

Science Process Skills Examples using Nature

To explore science in nature, students at Marshall Early Learning Center and Ms. Gomez's dual language classroom were guided to collect items from the outdoors in their school environments as well as collecting items from their own homes, backyards or communities. The decision to have students collect their own items was to intentionally encourage students to focus on the organic items that nature can offer science inquiry.

Buoyancy: Pinecone Sink and Float

The following image (Figure 2.) displays a pinecone immersed in water to allow Early ELs to apply several science process skills involved in this activity. From authors' observations and additional sources of data, the use of the following process skills was implemented: observation, prediction, and communication.

Figure 2. Pinecone Sink and Float

Science Process Skill: Observation. As students were gathered around a table, the teacher provided them with a jar filled with ¾ water and a pinecone was submerged in the water filled jar. The teacher asked students to observe the pinecone in the water and share with their classmates everything they were observing. As students shared their observations with their classmates and teacher, they were able to construct an understanding of the effects of an object from nature when placed in water resulting in sinking or floating of that object. Attention to the thinking and details of Early ELs' observations of the submergence in water was pivotal for their development of scientific thoughts and ideas about the overall concept of buoyancy. The scientific thought and development of ideas were facilitated using language as a way to construct observations and consult with prior knowledge to build new scientific knowledge.

Science Process Skill: Prediction. At the initial portion of this lesson on buoyancy, students were guided to engage in further discovery of the pinecone. The students expressed their excitement to see a pinecone submerged in a glass jar with water. The teacher along with the students submerged a pinecone in a glass jar with ¾ of water. Then the teacher asked the students to observe for a few minutes. Their observations were scaffolded by their teacher who used questioning to encourage the students to make their own predictions about what would happen to the pinecone as it was submerged in water. So, the teacher initiated with the students a short discussion that prompted their predictions about what they were observing as the pinecone was put in a jar of water. The teacher elaborated their predictions by posing the following questions: Would it sink or stay above water? What would it appear like tomorrow in size? The students then responded with their predictions based on their observations of the position of the pinecone in the water (above or below) and the size of the pinecone. The students also shared their predictions as to how it would appear (small or big) the next day.

Science Process Skill: Communication. To support Early ELs' language development and scientific discourse, the teacher encouraged students to discuss their observations and predictions using sensory exploration. In prompting students to engage in short discussions with their peers, Early ELs were able to communicate their observations and predictions using gestures or their current linguistic proficiency in English while developing critical grammatical structures that would provide opportunities for constructing scientific academic language. For example, students shared using their senses to explain their observations and predictions about the pinecone submerged in water. It was observed that students used the academic vocabulary presented by the teacher as well as acquiring new vocabulary which facilitated their understanding and stronger communication of these new learning experiences to their peers. See Figure 6. as a related example for scaffolding communication.

Classification of Objects Found in Nature

In order to identify the different properties of objects found in nature, teachers at Marshall Early Learning Center engaged students to collect different objects found in their outdoor classroom. In Figure 3., students were asked to classify their findings based on the property of color of the object which they collected from the outdoor classroom or nature found in their school grounds. The process skills that were focused upon by the teachers were observation and classification.

Figure 3. Classification of Nature Objects

Science Process Skill: Observation. The activity started with students sitting in a circle and passing around the items they gathered on their nature walk to prepare for the classification activity. Ms. Galvan first modeled for the students using her own classification graphic organizer or sorting poster and demonstrated to the students with their assistance how to classify each object she had selected during the nature walk. Each student communicated their observations to their teacher and peers as the teacher demonstrated how she classified objects based on their properties. The teacher asked several questions to get the students to pay close attention to their observations. After this initial introduction, Ms. Galvan asked students to go to their tables to classify their objects. Figure 3. shows the objects prior to classification based on their color property.

Figure 4. Classification of Nature Objects

Science Process Skill: Classification. Since Ms. Galvan gave the students the opportunity to visually see the graphic organizer or sorting poster and informed them of the steps they would take to classify their objects. After she explained the activity, the students returned to their desks and began the classification activity in groups of 3 students. Ms. Galvan provided each of them a magnifying glass so that they could clearly observe the details in their objects. Both Ms. Galvan and her assistant monitored the students and asked them several questions in the appropriate usage on how to use the magnifying glass for the classification of their objects. The students responded to the teachers and asked questions when they were having difficulty and engaged with their table partners by working together or talking to one another on how to classify their objects based on their observations. Figure 4. shows the classification of the objects. As a wrap up, Ms. Galvan and her assistant approached each of the groups and asked them to share how and why they classified their objects in each color category.

The Sun's Rays as Heat Transfer

Figure 5. Puppetry of the Sun's Rays

Science Process Skill: Inference. In Ms. Gomez's kindergarten dual language classroom, when learning about the weather, Early ELs went outside to observe what a sunny day was like. As they observed and felt the sun's heat, they shared their ideas as a class with their teacher and peers. Then upon their return to the classroom, they made puppets of the sun (see Figure 5.) In their construction of their puppets, the students demonstrated their inference of how hot the sun was and their red-orange strokes indicated their conclusions and understanding of heat transfer via the sun's rays they observed earlier in the lesson outdoors.

Science Process Skill: Communication. After Ms. Gomez's kindergarten dual language class created their puppets, they engaged in a puppet show that retold their earlier experiences of being outside and observing the sun. Ms. Gomez placed each of the students in pairs where they each role-played the sun based on their learning of the sun's purpose, particularly emphasizing heat transfer. Each student placed the mask over their face and engaged in an open-ended conversation about how they drew conclusions about the role of the sun and its effects on everyday living organisms. Students' inferences allowed them to communicate their understanding of how plants need the sun to grow and to also support other living organisms' survival in nature. They spent their time engaging in this role-playing puppetry that resulted in their scientific academic language and conceptual development.

Accelerating Language Development Using Effective ESL Strategies to Promote Science Literacy

In this section of the article, we provide ESL strategies observed at Marshall Early Learning Center and Ms. Gomez's kindergarten dual language classroom that facilitated the use of the

science processes to engage in science inquiry and literacy. Davis, Harris, and Cunningham (2019) found that strategies also accelerate multilingual language development and consequently, build resilience in Early ELs.

Strategy #1 Anchor Charts. An anchor chart primarily serves teachers and students in a large written form a space where factual information is visually represented to increase comprehension of, for example, a process, living cycle and/or for vocabulary building. Saunders and Goldenberg (2010) explain that anchor charts are effective visual representations to support an EL's language development and meaningful communication. The following anchor chart, for example, served as a visual for Early ELs to predict what would happen to a pinecone as it was immersed in water. Using anchor charts are also effective ways to scaffold science learning for Early ELs since the visual representation allows for access to the science Discourse (Gee, 2011) that students need to comprehend and incorporate into their own vocabulary. In Figure 6., we see how a PreK-4 teacher created an anchor chart to explain and reinforce key everyday vocabulary such as naming an object or pine cones and develop key vocabulary to express their predictions of observed science phenomena.

Figure 6. Anchor Chart

Strategy #2 Questioning. As demonstrated in Figure 7., questioning was also used to engage Early ELs in developing their higher order thinking skills and the application of the science process skill of communication. When teachers modeled either in print or orally their questions, students were given the opportunity to listen or observe the English language. This activity prompted the students to use their own musculature to voice and pronounce key vocabulary and English language structures resulting in discourse that would support their communication during science inquiry. Such an opportunity allows an Early EL to engage in metalinguistic awareness contributing to vocabulary development and comprehension to accelerate their English proficiency and communicative competence (Hymes, 1972). In this example below, the PreK-4 teacher is intentionally creating the opportunity to connect the Early ELs' learning about the ingredient of a ginger root found in nature and its relationship to a gingerbread cookie that was the focus of a story that they had read earlier in the day. By participating in this activity, Early ELs were prompted to engage in the development of synonyms as a way to build academic language in science contextualized in nature.

Figure 7. Questioning

Strategy #3 Realia. Realia also became an essential strategy to build on the students' prior knowledge to learning science content topics. Both the teachers at Marshall Early Learning Center and Ms. Gomez were very intentional in engaging the students in collecting or bringing into the classroom natural objects from the outdoor classroom to use as an object of study for scaffolding new science concepts and learning science process skills. For example, the use of real pinecones (see Figure 2.) to demonstrate sink and float and apply the science process skill of prediction was important to understand the science concept of buoyancy. Another example was a PreK-4 teacher's use of the leaves, cotton, and paper pieces to create a bear's den supported by the inclusion of authentic science literature for science language and literacy development. In Figures 8., 9., and 10., we see the examples of these natural resources to facilitate the scientific concept of hibernation. In Figure 8., we view the introduction of low frequency vocabulary to understand the scientific phenomena of hibernation. The teacher presented these two words and added visuals to help scaffold students' understanding as to why bears travel to a cave to hibernate in the winter months just as birds migrate to other locations because of climate changes. In order to simulate and provide concrete experiences for Early ELs, the teacher provided the following items as symbolic representations for winter conditions. For example, the teacher used cotton to represent snow (since snow is less accessible in this part of the U.S.), paper pieces as ice, and leaves to represent the outdoor foliage (branches, trees, leaves, soil, rocks). Using these materials, the teacher informed the students that in the natural environment all of these nature objects combine with the snow and ice to encase the cave and protect the bear during hibernation. In Figures 9. and 10., Early ELs were provided these materials and they were able to use their own creativity to build a simulation of a bear cave.

Figure 8. Understanding Hibernation

Figure 9. Materials to Create a Bear Cave

Figure 10. Actual Bear Cave Created by an Early EL

Scientific inquiry is not an easily acquired approach and must be scaffolded using realia to ensure that when students are able to engage in abstract levels of thinking, their prior experiences in science inquiry correlates with their ability to manipulate and use scientific concepts to expand and deepen their knowledge in science and other interrelated content areas (i.e. math, social studies, reading, art, etc).

Strategy #4 Sentence Frames. Rich language opportunities were presented in the early childhood classrooms to extend both content mastery and academic language development in paired learning with examples of "turn and talk," which is an oral language support strategy that provides ELs scaffolded interactions to formulate ideas and share their thinking with another student (Coleman & Goldenberg, 2009). In order to strengthen the effectiveness of the turn and talk strategy, all the teachers observed used sentence stems as ways for their Early ELs' to verbalize their thinking. The teachers used sentence frames to scaffolds their Early ELs' comprehension of science that provided talk at a peer level and served as a model close to the language the EL controlled. For example, the turn and talk activity in the science learning station in Ms. Gomez's kindergarten dual language classroom was an approach for ELs to role play with the puppets they created and orally shared their inferences. By designating each member in the learning station as "Partner A" or "Partner B," Ms. Gomez ensured that the ELs actively participated by directing "Partner A" to pretend that she/he was at the park and they were to impersonate the role of sun based on their observations made outside. Partner B asked questions about what Partner A observed and identified the time of the day.

Example of sentence stems for inference (related to Figure 5):

I infer that _____ . (Students can respond: the sun feels like its burning.)

We infer that _____ . (Students can respond: the sun is very hot.)

I infer that the sun is so hot in the _____. (Students can respond: afternoon.)

Discussion

Science is an integral part of the learning environment in an early childhood classroom. However, when students are provided opportunities to flourish in their scientific creativity and experiential learning, they are able to strengthen their own notions about scientific phenomena that surrounds them on a daily basis from their environment. In particular, Early ELs benefit and grow in their learning when they are provided the opportunities to explore and investigate science in organic environments (Huerta & Jackson, 2010). From the science process skills and ESL strategies presented in this article, teachers of Early ELs provided best practices for their students to engage in science concepts through the use of the outdoor classroom. Using the

science process skills such as prediction and communication to develop scientific inquiry was essential to initiate for children, who are naturally curious at this stage in childhood development, an exploration and motivation for this type of learning. Also questioning was used as a source to encourage science inquiry for Early ELs. Teachers used anchor charts (see Figure 6.) to model questions and included science process skills so that the students could explore and attempt to answer their own questions.

Based on our observations, it was also found that Early ELs were allowed to manipulate objects or realia from nature to understand the concepts of buoyancy, properties of objects, heat transfer, and hibernation. Such scientific concepts are the building blocks for future science learning that is expanded when progressing through grade levels of higher academic learning. By the teachers providing this scientific foundation, students were allowed to strengthen their initial knowledge base derived from their prior cultural experiences which made connections to the scientific reasoning and argumentation of these concepts. Young children are constantly interested in finding ways to apply their emergent scientific thinking and reasoning skills (Gelman & Brenneman, 2004). Teachers at Marshall Early Learning Center and Ms. Gomez's kindergarten dual language classroom provided opportunities for their students to engage in scientific thinking and reasoning by using the science process skills as tools for learning and implementing ESL strategies that facilitated the use of academic language for science inquiry and literacy.

Conclusions

In conclusion, teachers of Early ELs should continue building their own pedagogical approaches to science learning that allow for students to engage in science inquiry and literacy through the use of nature based practices. Moreover, teachers should address the science content standards through the lens of nature and all its benefits to young learners, particularly ELs who are also acquiring a second language. In addition, beginning the development of science inquiry and literacy in the early childhood classroom, allows for the potential for future interest or strong background in science that will provide problem-solving skills and scientific reasoning that can perpetuate future solutions to everyday challenges or issues. As it currently stands, in the 21st century where technology in science is of high demand, the constant diminishing of interests in nature has led to a nature deficit disorder (Louv, 2005) in our current generations. Therefore, as educators in this global world, we need to provide examples of how to counter a nature deficit in the context of science learning and build on its potential in the classroom along with technological advances. There are plenty of spaces where old technologies stemming from nature and new technologies can be integrated to develop future scientists that employ all the natural resources as well as the digital resources to apply to science education (Cunningham, 2018). Lastly, it is important to recognize in addition to best practices in science, science process skills and ESL strategies, nature provides resources that can be gathered from the outdoors that reduces the cost for funding in early childhood classrooms, provides equitable spaces for science learning, and where fine motor skills and tactile experiences are needed to address the developmental needs of Early ELs.

Implications

There are several implications derived from this article to enhance the experiences of Early ELs in an early childhood science classroom. Early ELs can benefit from experiences provided that embed the resources found in nature to learn about important scientific concepts that affect them

in their daily lives. As well, science inquiry allows an Early EL to engage in scientific thinking using the vehicle of language to understand and reason about their own conjectures or opinions. By utilizing language, Early ELs are allowed to develop specialized vocabulary that contributes to the science discourse needed to access science learning in an early childhood classroom. As well, the sometimes impromptu nature of science inquiry allows an EL to benefit from the expected and unexpected outcomes of the teacher's objective in the learning activity. Moreover, when a teacher provides ESL strategies intentionally for learning, such as learning about classification using objects in nature, the EL has the opportunity to learn the corresponding science vocabulary and properties of an object. Such learning accelerates the content and language development needed for an EL and it is recommended based from the authors' observations and findings that early childhood educators include this in their pedagogical approach. The use of the science process skills in an early childhood setting begins to engage Early ELs in scientific based practices that are applicable in other content areas such as reading, math, social studies and art. To conclude, the use of the science process skills along with ESL strategies become tools for future science learning as presented in the elementary and secondary contexts that will provide opportunities for innovation and creativity that will benefit the EL as they move towards their own scientific expectations and goals.

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FACILITATION MATTERS: STRATEGIES TO SUPPORT EFFECTIVE ONLINE TEAM COLLABORATION

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ABSTRACT

Effective collaboration is a critical component in the success of schools and districts. The pandemic, however, has moved many of these spaces online. Many of the same challenges that were present during face to face interactions largely still exist online, making strategies paramount in supporting teams to effectively collaborate in an online environment—even beyond the pandemic. Rather than simply putting people together online and expecting them to become a team, this article leverages the research of effective teams and provides leaders with concrete actions they can use in facilitating meaningful collaboration online.

FACILITATION MATTERS: STRATEGIES TO SUPPORT EFFECTIVE ONLINE TEAM COLLABORATION

As education leaders grapple with the unrelenting pressure to reopen schools during a pandemic, as well as, continue to maintain health and safety and focus on student achievement, schools and districts across the country will turn to “innovative” and “outside-the-box” solutions. More often than not, schools and districts see underwhelming results, with many of these solutions not living up to their hype. Even before COVID-19, the education field invested billions of dollars every year in search of solutions to significant changes in student outcomes. Leaders often focus on the exciting and new aspects of large-scale change, overlooking the important step of developing an understanding of their organizational culture and what collaborative conditions are needed to create this change.

Research shows that effective collaboration among leaders is a key lever in helping schools and districts change, and that including teams in decision-making, development and implementation will increase the likelihood of success of any initiative (Fullan et. al., 2015); Harris, 2014; McNulty & Besser, 2014; Leithwood & Seashore-Louis, 2012). The need to deepen authentic team collaboration will only intensify as teachers and leaders engage in hybrid and virtual models of school. Educational leaders must continue the development of effective communication and collaborative opportunities within existing school and district structures (Hargreaves & O'Connor, 2018). Teams that invest significant time in deepening these collaborative structures at the district, school and classroom level will result in better implementation and better student outcomes.

One way to build a more collaborative culture is to invest time in building teams that work together not because they are told to do so, but because they see how it will improve their experience and the ability to reach their goals. Developing these kinds of collaborative teams takes time and effort. But ultimately, being intentional about building trust and creating an environment where teams feel safe to ask questions, take risks and make mistakes will help ensure the kind of culture, even virtually, where initiatives can evolve and ultimately take root.

As schools, districts and other educational organizations navigate a post COVID recovery and school reopening, virtual collaboration will play an increasingly important role moving forward. Teachers and leaders will find it increasingly necessary to develop collaborative spaces using online platforms. Leaders can leverage the research around the characteristics of effective teams to support this transition (Shafer, 2016; Aguilar, 2016; Gallimore et. al.,2009). The strategies outlined in this article take into account these research-supported characteristics and applies them to online team collaboration. District, school and teacher leaders can use this as a resource to support teams as they learn how to navigate online collaboration platforms.

Before collaborating, there are a few key strategies to support the planning, one of which is vitally important. Leaders need to identify the "why" before the "how” and communicate it to their teams. The following strategies are helpful before collaborating in an online environment:

- **Define clear purpose.** Teams need to understand the desired outcomes. There is a difference between a meeting and collaboration. Clarify if the collaborative time is for dialogue (supporting understanding) or discussion (making a decision).

- **Schedule time wisely.** Not every meeting needs to be scheduled for an hour. Determine a timeframe based on actions that need to be accomplished by the team.

- **Establish key roles.** Effective teams provide structure and support by having roles identified and assigned to participants. Determine who will serve as the facilitator (someone familiar with the online platform), recorder, time keeper and process observer. Also consider a technology moderator who can support online logistics (i.e chat room comments, breakout room organization, etc).

- **Check technology.** Time can be wasted when technology does not work as expected. Make sure the facilitators and participants know how to use basic tools before the meeting.

During collaborative time, it is important to establish coherence and meaning for all team members involved. Educational leaders need to use tools and protocols that create alignment between priorities, strategies and initiatives for stakeholders, which include teachers, principals and other district staff. The following strategies are helpful while collaborating in an online environment:

- **Display agenda visually.** Agendas with clearly articulated times can serve as visual guides to keep team conversations on track and should be provided in advance to increase preparedness.

- **Begin with team check-ins.** Context and relationships matter. Start your time together by building connections and trust before getting into the work.

- **Refine team norms and expectations.** Online collaboration brings both opportunities and challenges that are different than face to face interactions. Norms and expectations may need to be adjusted or created.

- **Utilize the camera when possible.** Seeing team member's facial expressions and non-verbal communication can enhance psychological safety and trust. It also helps the facilitator determine levels of engagement and adjust protocols as needed.

- **Incorporate multiple tools for interaction.** Collaboration needs engagement to be effective and meaningful. Use online platform tools, such as chats, screen shares and breakout rooms. This is especially important for large groups and longer periods of collaborative time.

- **Leverage discussion protocols.** Similar to guardrails along a highway, protocols keep teams on track and provide safety while engaging in inquiry based discussions. Facilitators should utilize protocols to resolve conflict and come to consensus when making decisions.

- **Allow extra wait time.** With all of the ways to communicate in an online platform and the frequent delay from the mute function, allowing extra processing time ensures members have an opportunity to contribute.

After the collaborative time ends, follow up actions may not be carried out strongly if the team members lack clarity from the conversation. Follow-through is vastly important for building trust among colleagues. The following strategy is helpful to support ongoing work after meeting in a virtual environment:

- **Determine next steps and timelines.** Establish a shared space to write down key actions, who is responsible and a timeline for completion. Send an email immediately after the meeting to increase clarity, which is often seen as an antidote to anxiety.

The positive conditions created through these strategies set the stage for effective collaboration and systemic change. Schools and districts do not need any more "solutions" to support reopening schools, they need help creating organizational systems and structures that deepen collaborative opportunities for teachers and leaders to solve their own problems. Meaningful change requires a high degree of collaboration at all levels of the system. To implement large scale change in education, leaders must stay focused on creating collaborative conditions, even in an online setting, that will fuel the outcomes that our students, families and community deserve.

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LOSING A CAMPAIGN: AN ANALYSIS OF THE ROLE OF TEACHERS
Participation in the Political System

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ABSTRACT

Today's public schools are facing challenges unlike any era prior. By using the lens of political activism specifically, running for an elected office, it is possible to analyze the threats to public education and the need for more political engagement from teachers and teacher educators. Analysis of challenges to teacher political engagement including demands on teachers and the more critical needs of students gives insight to the need for more teachers as political advocates. Global issues, such as, COVID-19 are stressing schools across countries and continents. It is, therefore, critical for teachers to be engaged in political activism through curriculum, modeling, professional associations as well personal strategies like voting and running for office. Teachers' voices need to be heard in order to meet the challenges of today's schools.

LOSING A CAMPAIGN: AN ANALYSIS OF THE ROLE OF TEACHERS
Participation in the Political System

Introduction

In spring of 2016, amid the national chaos of the upcoming presidential election, a smaller race was shaping up in Texas, specifically east Texas. A race for an open spot on the State Board of Education. State boards are typically low excitement races that fill seats to create and approve curriculum, instructional practices, and other public schools' issues. This race, however, was different and I was one of the candidates.

The District 9 State Board of Education race in Texas made national headlines. Mary Lou Bruner was one of three Republican candidates in the primary race. She was a retired schoolteacher and she made outlandish claims about the curriculum needs for Texas. In an article from Texas Monthly, she is reported saying "the dinosaurs died out because they were just babies on Noah's Ark, and thus unable to be fruitful and multiply after that ship came to rest; climate change is a hoax orchestrated by none other than Karl Marx himself; and Islam is not a religion" (Lomax, 2016). Bruner won 48% of the vote while her opponent, Keven Ellis garnered 31% leading to a run-off. The same article stated the Democratic challenger, me, is "believed to have no chance in the November election" (Lomax,2016). It was, therefore, a race to be determined in the primary and the front runner was, at the least, uninformed and at the most, dangerous. Eventually, the primary went to Keven Ellis, a chiropractor, and he won against me in November.

For me, I wanted to lend expertise to the board of education as professional service. As a Democrat candidate in east Texas, I knew had little chance of defeating a Republican candidate, but I ran anyway. What I did not know was what I was really signing up to do. The experience led to so many questions and revelations.

Who should be included on decisions of curriculum? What is the role of teachers in advocacy for the public school? How should teacher candidates be prepared to lead? Why are there not more teachers running for office?

For years, teachers and professors have argued whether teaching is a profession. At this point in time, four years past my experience as a candidate, that question is not the question to ask. Rather teachers and teacher educators need to ask: How do we save public schools? In the era of the Trump presidency, teachers and teacher educators need to become advocates for the public schools and must participate in the political system in ways they have not done before.

Teachers and Politics

In this section, the challenges to teacher participation in the political system will be analyzed. For this section and the remainder of the paper unless noted, teachers will include preservice teachers and teacher educators. Mainly the challenges to teacher participation will be unpacked. Challenges to participation include inclusion and representation in office, demands on resources, and the immediacy of teaching.

Representation and Inclusion in Congress

To participate in the political system, one could take many paths. Obviously, voting is a powerful act in and of itself. But it is important to know who the candidate is and how are they serving. The Texas State Board of Education is comprised of 15 members. Currently, 7 members report being either teachers or educational leaders in their biographies (*SBOE-State Board of Education*, 2020). The rest of the committee includes 4 members with business backgrounds, 2 medical doctors, and 2 from other areas. The majority of the board has no experience in public education.

The national picture should also be examined. The Congressional Research Service (2020) reports the demographics for each congressional group. The following table shows the most frequently reported occupations in the current United States Congress.

Table 1: Occupations Reported in the 116th Congress

Occupation	**Representatives**	**Senators**
Public Service/Politics	184	47
Business	183	29
Law	145	47
Education	73	20

Source: Membership of 116th Congress: A Profile by Congressional Research Service

The number of teachers in Congress looks somewhat promising, not a majority but a good representation. However, it is important to take a deeper dive. Each branch of Congress works in committees. The House has the Committee on Education and Labor and the Senate has the Committee on Health, Education, Labor and Pensions. The House committee is broken down further into subcommittees including Subcommittee on Early Childhood, Elementary, and Secondary Education and the Subcommittee on Higher Education and Workforce Investment.

The Senate Committee on Health, Education, Labor, and Pensions is comprised of 23 members. Each members' biography was read to identify the early career field of each member on the Senate webpage (*U.S. Senate Committee on Health, Education, Labor and Pensions*, 2020). Although one member included one year of teaching in his biography, only one member was a career teacher, Elizabeth Warren.

Table 2: Occupations of Senate Committee on Health, Education, Labor and Pensions

Occupation	**Number Reported n= 23**
Law	7
Business	8
Other Professions	5
Medical	2
Teacher	1

Source: Author's analysis of Senate biographies

The House has two subcommittees that relate to educational issues. The data for both are reported below analyzed from the House webpage (*Education and Labor Committee-Membership*, 2020).

Table 3: Occupations in House Subcommittees

Occupation	**Early Childhood, Elementary and Secondary Subcommittee n= 13**	**Higher Education and Workforce Investment Subcommittee n=27**
Public Service	3	5
Law	0	5
Medical	2	1
Business	5	7
Higher Education	1	3
Teacher	2	1
Other Profession	0	5

Source: Author's analysis of House biographies

One of the teachers that serves on the Subcommittee for Early Childhood, Elementary, and Secondary Education is Jahana Hayes who was the National Teacher of the Year for 2016 (Walker, 2016) and has over a decade of public school experience. However, these committees only have 4 congressional members that have been public school teachers and 4 from higher education. According to the Congressional Research Service (2020), there are 93 members with educational career backgrounds. Why are there not more congress members with education experience serving on educational focused committees? Answering that question is not in the scope of this paper, but it is an important question to consider.

It seems clear that lawyers, business professionals, and career politicians are the majority in Congress. One disadvantage that a career educator has in becoming a congressional member is the amount of money it takes to win a seat in Congress. According to the *Vital Statistics on Congress* (2019), to win a seat in the House would cost $1,516,021 and to win a Senate seat would cost $10,464,068.

Demands on Teachers

Demands on teachers have not only increased within the job in the past decades but also increased from external societal changes. Within the requirements of the job, teacher duties have evolved to include more time on standardized testing and accountability work. High stakes testing has expanded from a hurdle for students to clear for promotion and graduation to an obstacle for teachers to gain pay raises and, in some cases, job security. According to the Phi Delta Kappan (2019), teachers identified the biggest problems facing schools. From the 1970s to mid-1980s, it was lack of discipline. From the mid-1980s to the early 1990s, it was the use of drugs. Then each year it changed until 2002 and since then, it has consistently been lack of financial support. The same report asked teachers why they have considered leaving the profession. The most reported answer was having inadequate pay (22%) followed by stress/pressure/ burnout with 19%.

Student Needs

In 2020, students' needs challenge teachers' time, determination, and resources. As a society, America still has children who do not have their basic needs met. According to Maslow (1943), basic needs include physiological and safety needs. The National Center for Educational

Statistics (*The Condition of Education*, 2020) states that in 2018, 18% of children were living with families in poverty. Poverty affects the ability to provide food, water, and shelter that are the foundational needs of children. The second level of basic need includes safety. The NCES reports that between 2000 and 2017 there were 37 active shooter incidents at elementary and secondary schools (Musu et al., 2019). Today's school children practice active shooter drills instead of the duck and cover drills of generations past. While these are two examples of the modern needs of students, the list could be extensive. However, the argument here is that teachers are not able nor afforded the opportunity to participate in major political activities when their time, talents, and hearts are taken up with meeting the basic needs of today's students.

The current environment in politics leaves little entrance way for current teachers. National and state systems make the possibility of an educator assuming office and participating in meaningful committee work a narrow reality. School environments demand more from today's teachers than ever before and it is evident in reported levels of burnout and leave. Finally, the cumulative social issues that face modern students also puts constraints on the time teachers may have given to political advocacy.

Lessons Learned

Through my candidacy, I learned a great deal from the constituents I met. Questions and comments from the attendees of events at which I spoke were often surprising. Many of the concerns and questions were not what I had anticipated. I had overestimated and underestimated the voters. Three issues are important to explore in order to understand the need for teacher involvement in local, state, and national politics: lack of understanding, parental conflict, and local investment.

Lack of Understanding

I spent many events answering questions on how the education system works. To me, as a teacher educator, the ins and outs of the huge bureaucracy of education is second nature; it is a daily environment I visit. For many of the voters, the experience of the education system ended with graduation and for some, even before graduation. The Texas State Board of Education has the responsibility of "setting curriculum standards, reviewing and adopting instructional materials, establishing graduation requirements, overseeing the Texas Permanent School Fund, appointing board members to military reservation and special school districts, providing final review of rule proposed by the State Board for Educator Certification, and reviewing the commissioner's proposed awarded of new charter schools" (*SBOE-State Board of Education*, 2020). Most of my speeches covered these areas with a short explanation of each. At most events, a potential supporter would ask about standardized testing and I would explain that the regulations for that come from the legislature and are enforced by the Texas Education Agency. The further into the campaign, the clearer it became that there was a general lack of understanding about how the Texas educational system worked, but there was also a great interest in knowing about the cogs and wheels. Although I lost the election, I did feel a sense of accomplishment that I was able to answer many questions about the system. It also made me realize that a lawyer, business owner, or medical professional may or may not have had the same nuanced insight.

Parental Conflict

Although there was always a mixed crowd at campaign events, many parents showed up to SBOE panels and discussions. Many times, after the formal event, informal conversations would take place. After on evening event, a mother followed me into the hall. She was concerned about the quality of her local school district and her young child's education. She asked me if she should send her child to private school. She was torn between working within the system and opting out for what she thought was a guaranteed better alternative. In a report from Phi Delta Kappan (2019), when respondents were asked if to rate schools with letter grades, 76% rated their child's school with an A or B, 44% rated their community schools with an A or B, and 19% rated the nation's schools with an A or B. These percentages are relatively steady since 1974. It is easy to be critical of a system when viewed as the national bureaucracy of education. However, when the school system becomes personal through participation and interactions with individual teachers, people are more satisfied. Knowing that parents are torn about the decisions for their children's education makes it all the more important for teachers to be involved at a systemic level through advocacy and politics.

Local Investment

As I began my candidacy, I had no expectations about events or crowds. However, I was pleasantly surprised that people did show up to hear SBOE candidates, though not in the numbers a gubernatorial or legislative candidate could amass. For me, I learned that the constituency of Texas was invested in public schools. At different events, I had voters ask about the specific curricula for their local districts and not all these people were parents. Business owners and local leaders had an interest in what has happening with the students of their district. Even so, NCES reported (*The Condition of Education*, 2020) that there are over 3 million school children enrolled in charter schools in 2017 compared to just under 500,00 in 2000. Additionally, Secretary of Education Betsy DeVos has been a strong proponent of charter schools announcing this year that $65 million would be available for expansion of charter schools (*Secretary DeVos Awards $65 Million to Create and Expand Public Charter Schools in Areas of Greatest Need*, 2020). Charter schools challenge the stability of the current public school system. In order to maintain a strong public school system that has local investment, it may be time for teachers to step forward to lead.

Through my run for state office, I gained understanding of crucial mindsets of voters in Texas. People craved more knowledge about the education system in general. Parents stressed about making the "right" choice for their child's education. Voters valued their local schools and districts. According to an article in Education Week (Will, 2018), only nine states require one member of the state board to be a teacher and of those only four allow the teacher representative to vote. For me, this is a very clear indication of a need for of the call to action for teacher advocacy.

Globalization and Education

Today's students are living in world that is connected in ways that were not even imaginable in decades past. In classrooms of the past, teachers focused on the students in their small classroom. Rarely would global issues affect the day-to-day instruction of those classrooms; today we cannot disconnect from the larger world. Just in the past few years, schools have been changed by global events and issues.

Currently, schools all over the world are still facing challenges of bringing instruction to children in areas where COVID-19 is spreading. In the United States, states and school districts are making hard choices about the modes of instruction. The following table indicates the methods by which states are addressing the pandemic and how schools will operate.

Table 4: Type of Instruction by State (as of August 2020)

Type of Instruction	**Number of States (including Puerto Rico)**
State-ordered in-person instruction available part-time or full-time*	4
State ordered closure in effect (including states where openings are delayed)	6
State-ordered regional closure in effect	2
Varies by school/district/dependent on local health authorities	36
Only hybrid or remote instruction allowed	3

*****States with an order to provide in-person instruction may grant waivers to individual districts. Orders include public statements or actions from governors and state officials. They may be subject to waivers or overridden by other officials.

Source: (*Map: Where Are Schools Open?*, 2020)

Schools all over the world are affected by major global events. Climate change is a challenge for all countries. Racial tensions in the United States have ignited supporting protests across borders. Furthermore, according to the MacMillan Center at Yale (*Democracy and the Rise of Authoritarianism in COVID-19 World*, 2020), the pandemic has "eroded democratic practices in some states and contributed to a more overtly authoritarian form of politics in others." Schools are not disconnected from these global issues due in part to the connectedness of the students. Teens like Greta Thunberg, the Swedish activist fighting climate change, and Emma Gonzales, the activist for gun control, are making the world smaller and bringing the issues to schools. If that is the new normal, then teachers need to become part of the global answer.

Call to Action

At the end of my campaign, I was not surprised with my defeat. My opponent, the chiropractor, would go on to be appointed the chair of the Texas SBOE the next year. Again, I was not surprised, but I was changed. Now I understood the softness of the voice of teachers in politics and I needed to become an amplifier for those voices.

To ensure that the professions continues to grow and develop, it is critical to utilize the resources we have. These recommendations are ones that will unify a voice of teachers and leaders to fight for the schools they believe in. Teachers must become more than the leader in front of the classroom; we must be leaders in our districts, states, and nations. Now is the time to act.

Teachers and teacher educators must work within this now connected global village to better the world. Pushing a personal agenda for one candidate or another is not the ethical approach; the approach should be to help grow ethical global citizens. To do that, teachers must use all the resources they have.

Curriculum

State and national curriculum standards are still the guide for all teachers. However, how to present the material is still the choice for most teachers. Teachers have choices in novels, plays, and music that is taught in their classrooms. Instead of relying on the old standard European examples, teachers move to a culturally sustaining pedagogical model and include works from around the world and works that are more connected to the current world of the student. Django Paris stated in Education Week Teacher (Ferlazzo, 2017), "Culturally sustaining pedagogy exists wherever education sustains the lifeways of communities who have been and continue to be damaged and erased through schooling. As such, CSP explicitly calls for schooling to be a site for sustaining—rather than eradicating—the cultural ways of being of communities of color." Teachers need to be beacons that light up the worlds of students of color and disenfranchised youth rather than becoming a blanket that makes all the world dark. Sometimes this means spending time in the classroom on issues that are not necessarily on the lesson plan for that day. For teacher educators, it means classrooms should be places where real conversations about who todays globally connected but politically overlooked students are.

Modeling

There is an opportunity to model engaged citizenship in both public schools and colleges and universities. Teachers can model ways to talk to people with opposing viewpoints. Teachers can model inclusion and tolerance. In the political sphere, teachers can share how to vote, how to support a cause, or how to research candidates all without forcing a mindset. Teachers teach how they were taught so it is critical for teacher educators to be a reliable model for the preservice teacher.

Professional Associations

All teachers need to participate in some professional association. Many times, new teachers are given the advice to join an association just to have liability insurance. Yet there is more to be gained by being active in a professional association. Most organizations have some newsletter or blog that informs members of issues facing the profession. At the very least, the association offers a way to connect to other teaching professionals in similar content areas, locations, or interests which may kindle conversation about professional issues and answers.

Personal Strategies

Additionally, teachers can employ several personal strategies to advocate for the profession. Teachers can contact their local school board, SBOE representative, or their congressional representative. For some issues, professional organizations will provide a form letter for anyone to use or modify to send to the political office. Most of the time, it is not the content of the letter, but the number of letters or calls or emails for and against the issue that make a difference. Technology has made the process of contacting politicians much simpler than in years past.

Technology also makes it easy to connect through social media. Most political offices have a presence on social media. By following the office, teachers will also get information in a timelier manner. Commenting and posting should be done in a professional manner in alignment with employment guidelines. Social media allows for connections across districts, states, and nations.

Teachers can also vote. According to the Census Bureau (File, 2017), in 2016, 61.4% of the voting-age population reported voting. There is room to make a difference if more people voted. Voting remains the most effective way to make a difference in politics. Also, teachers can help students register to vote.

Finally, teachers can run for office. For a teacher to be elected to an office gives all teachers a louder voice. And sometimes, it does not even matter if the candidate wins or loses. Sometimes, the process of campaigning and meeting people helps push the profession forward. Teachers need to look around and see who is on their local school board. Who represents them at the state level? Who represents them at the national level? Do these representatives believe in the public school? If not, what can teachers do? Become a candidate.

Conclusion

In conclusion, teachers have historically had, and currently have, limited representation in United States congress. They are also facing demands that make the work of education more challenging and taxing. Students' needs are affecting the work of teachers who try to meet all the needs they can. Today's teachers are also living in a more connected and global society where challenges are facing the world rather than a just city or one nation. All of these contribute to the critical need for teacher voices in the political sphere.

Teachers have many ways to help advocate for the profession. They can work within the curriculum; they can model citizenry for students. Teachers can also use personal strategies including contacting politicians, voting, and running for office.

In my experience as a candidate, I learned that teachers are needed in politics. Constituents are hungry for information about the system and the schools. Today more than ever, teachers need to be active in the fight for moving the profession forward. Too many good ideas, too many brave voices, too many unique experiences are being lost in the political clamoring. As teacher educators, we should be strengthening our collective voice to be heard and then sought out as a critical perspective to be included at the table.

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CHANGING WITH THE TIMES: Instructor Modeling in Virtual Environments with Preservice Science Teachers

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ABSTRACT

The outbreak of COVID-19 resulted in the closing of colleges and universities across the United States. Face-to-face instruction was stopped, and courses were offered remotely. Teacher preparation programs, responsible for ensuring that the next generation of teachers were still being trained, also had to adjust to providing courses virtually. This paper argues for the use of instructor modeling in virtual environments with preservice teachers who are being trained to teach science. Instructor modeling has been touted to be an effective method for modeling instructional behaviors and improving preservice teachers' knowledge and skills.

CHANGING WITH THE TIMES: Instructor Modeling in Virtual Environments with Preservice Science Teachers

Introduction

The need for effective science teaching is greater than ever. Scores reported on the Program for International Student Assessment (PISA), an assessment administered to 15-year-old students across more than 70 countries, placed students in the United States below several other developed countries in terms of performance in science (OECD, 2019). On the 2018 administration of PISA, the average science scores of students in the United States ranked 18th among countries whose students were tested on the science domain (OECD, 2019). Statistically, while small improvements in science were noted for students in the United States since PISA's last administration in 2015, the United States continues to lag behind in science performance.

Effective science teaching is critical to student learning and development and has been tied to student achievement in science (Munck, 2007; Johnson, Zhang, & Kahle, 2012). Teacher educators play a vital role in helping novice science teachers acquire and develop the skills needed to become effective pedagogues in their content area. Instructor modeling, when appropriately facilitated in courses in teacher preparation programs, has been touted to be an important method in ensuring that preservice teachers obtain the knowledge and skills that will be useful in future classrooms (Moore & Bell, 2019). This is especially true when modeling is approached in a manner that allows preservice teachers to examine and explore both actions, thoughts (i.e. rationales), and theories tied to modeled instructional behaviors and approaches (Moore & Bell, 2019).

This paper will discuss how instructor modeling can be facilitated in virtual environments with preservice science teachers. The 2019 outbreak of the coronavirus disease (COVID-19) resulted in the shuttering of colleges and universities across the country in 2020. The continuation of learning in remote environments have resulted in instructors having to be creative in how they continue to expose preservice teachers to high-impact teaching approaches. This paper will make an argument for the use of modeling in virtual environments and will describe how instructors can capitalize on modeling to improve the pedagogical practices of preservice science educators.

Brief Review of Relevant Literature

Teacher preparation programs have consistently been criticized for the underperformance of students in public schools, and for the teachers who serve in them (Bergen, 1992; Darling-Hammond, 2000; Moore & Bell, 2019). Calls for a greater oversight of teacher preparation programs, and the training of preservice teachers, have arisen from public concern that teacher education programs are not adequately preparing preservice teachers for the realities of working with diverse learners in classrooms (Feuer, Floden, Chudowsky, & Ahn 2013). Hence, research has continued to focus on strategies and approaches that seek to build preservice teachers' understandings of how to approach instruction in P-12 classrooms. Instructor modeling is one of these strategies.

According to Moore and Bell (2019), instructor modeling is the "practice of instructors intentionally demonstrating methods and behaviors which they wish to transfer to the preservice teachers in their influence" (p. 330). In their analysis of the importance of instructor modeling, Lunenberg, Korthagen, and Swennen (2007) noted that when instructors model certain instructional behaviors, preservice teachers "not only hear and read about teaching, they *experience* it" (p. 589). In addition, the scholars shared that to simply model instructional behaviors is not enough. As they explained, preservice teachers "must also be encouraged to focus on and to reflect on the meaning of this modeling, and how it can help them develop their own teaching" (Lunenberg et al., 2007, p. 589). Hence, instructor modeling must be carried out in an explicit manner that gives preservice teachers the opportunity to reflect on modeling experiences.

There are four types of instructor modeling discussed in the literature (Lunenberg et al., 2007; Moore & Bell, 2019). The four types of instructor modeling are (1) *implicit*, where instructors model instructional behaviors for preservice teachers, but do not explicitly state that they are doing so; (2) *explicit*, which involves instructors modeling instructional behaviors and explaining to preservice teachers that they are actually modeling; (3) *explicit with reflection and application to preservice teachers' practices*, which includes instructors explicitly letting preservice teachers know that they are modeling instructional behaviors, and providing preservice teachers with opportunities to reflect on how modeling impacts their learning and how instructional techniques can be applied in future classrooms, and (4) *explicit with reflection and connections to theory*, where instructors explicitly model instructional behaviors for students, connect modeling to theory, and guide students in reflecting on how modeling impacts their learning and how the instructional behaviors can be used in the future. Figure 1 below denotes the four types of modeling behaviors that can exhibited by instructors.

Figure 1. Types of instructor modeling.

Note: Figure constructed from types of instructor modeling as discussed by Lunenberg, Korthagen, and Swennen (2007) and Moore and Bell (2019).

The highly specific nature of teaching behaviors and approaches that need to be enacted in science classrooms may require a greater level of consistency in modeling on the part of science education instructors in teacher preparation programs. The 2020 Standards for Science Teacher Preparation, as developed by the National Science Teachers Association (NSTA) and the Association for Science Teacher Education (ASTE), identify six standards that teacher preparation programs should focus on as it relates to the professional training of science teachers. These standards are (1) content knowledge, (2) content pedagogy, (3) learning environments, (4) safety, (5) impact on student learning, and (6) professional knowledge and skills. To meet these

standards, preservice science teachers must be able to demonstrate their abilities to implement appropriate and effective instructional behaviors. Scott, Schroeder, Tolson, and Bentz's (n.d.) report identified several research-based strategies that result in impactful instruction in science classrooms. These research-based strategies include inquiry-based approaches, collaborative grouping approaches, questioning and assessment strategies, use of manipulatives and materials, use of various technologies, and facilitating contextual learning (i.e. making learning meaningful for students). To help preservice science teachers become proficient in the aforementioned approaches and strategies, instructors in teacher preparation programs, particularly those who teach methods courses and supervise preservice science teachers in the field, must be able to model strategies and approaches that are most effective in science classrooms. This remains true even as instruction in teacher preparation programs has shifted to remote learning environments.

Theoretical Foundations for Instructor Modeling

Instructors who make modeling an integral part of their instruction situate learning within the context of meaningful and realistic experiences that are tied to the teaching profession. The situated learning theory, as posited by Lave and Wenger (1991), focuses on the "relationship between learning and the social situation in which it [learning] occurs" (p. 13). Lave and Wenger (1991) advocate for social situations that allow authentic learning to take place. Hence, the learner participates in experiences that will allow for the acquisition and development of skills that are used by experts in the field (Lave and Wenger, 1991).

Scholars who have discussed the situated learning theory tout context as being an important component of learning. For example, Putnam and Borko (2000) shared the following: "…the physical and social contexts in which an activity takes place are an integral part of the activity, and that the activity is an integral part of the learning that takes place within it" (p. 4). The scholars then went on to say that "how a person learns a particular set of knowledge and skills, and the situation in which a person learns, become a fundamental part of what is learned" (p. 4). Putnam and Borko (2000) explained that situated learning contexts can include settings where the learning of subject matter for teachers is emphasized. Therefore, when instructors model instructional behaviors for preservice science teachers they can place an emphasis on how pedagogical strategies can be approached and implemented, and how strategies can best be used in classrooms (i.e. in the field). Modeling provides an opportunity for instructors to improve contextual learning, and, therefore, should be done with preservice science teachers. Since instructor modeling falls along a continuum, how well modeling is facilitated and enacted in a course is dependent on instructors who teach preservice science educators.

Considerations for Modeling in Virtual Environments

While the importance of instructor modeling is clear, how can modeling for preservice science teachers be effectively enacted in virtual learning environments? With the prevalence of COVID-19, uncertainty remains as to how colleges and universities will proceed with offering courses in the near future. While the California State University (2020) system, one of the largest in the country, has decided to offer most courses virtually for the 2020-2021 academic year, other colleges and universities are still determining their organization's course of action for the upcoming academic year. Even in the face of uncertainty, instructors must be prepared to use and

model best practices in courses, particularly those focused on preparing the next generation of science teachers.

When modeling in virtual environments, instructors should make several considerations as it relates to teaching preservice teachers. Instructors may want to ask themselves the following questions: What specific content should be modeled? How does the selected content relate to best practices that are needed for the teaching profession and for 21st century science classrooms? What technologies would be best to use for modeling and while instructor modeling is occurring? Are there other resources or materials that could be used to enhance the contextual learning experiences of preservice science teachers? Are these resources readily available for instructor or learner use? What is the best way to support preservice science teachers as they reflect and expound on learning experiences?

In addition to the aforementioned questions, instructors must also be decisive about how they would like to approach modeling in courses. Since instructor modeling can take several forms, instructors who want the most out of modeling should decide how they would like to proceed with this pedagogical technique. Explicit modeling, as an approach, has the benefit of alerting preservice science teachers that they are observing the modeling of instructional behaviors (Lunenberg et al., 2006; Moore & Bell, 2019). Instructors can "walk" preservice science teachers through the skills that they want them to develop, particularly when these skills are situated in authentic contexts to enhance preservice teachers' understandings of their own pedagogy development. At more complex levels, instructors can have preservice science teachers reflect on modeled behaviors and explore how instructional behaviors can be applied in a variety of contexts in science classrooms. In addition, modeled behaviors can be aligned to educational theories that drive the use and implementation of high-impact practices.
In virtual environments, special considerations must also be paid to how learners will interact with course content and materials. Should modeling be demonstrated live or should instructors prerecord modeling of skills? How should instructor modeling be embedded throughout the course? How will reflections and the application of content be handled? How will course discussions, journaling, or other descriptive activities be included to support and encourage reflective behaviors in preservice candidates? Since remote learning is enacted in a variety of ways, there may be no right answer. Hence, instructors must consider their own teaching contexts even as they work to train preservice science teachers.

Conclusion

Teacher preparation programs have been presented with a variety of challenges due to the COVID-19 pandemic. One of these challenges is ensuring that the quality and standard of instruction remain high even as traditional classrooms and field/clinical experiences in schools have been removed as instructional options. Ensuring that instructors can continue to teach in even the direst of situations is important. This is especially true for instructors who work directly with the next generation of science teachers. Instructor modeling can serve as an approach to ensuring that the knowledge and skill development of preservice science teachers are not compromised.

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