

JOURNAL OF LITERACY INNOVATION

RETHINKING LITERACY INSTRUCTION

VOLUME EIGHT, ISSUE ONE
SPRING 2023

ISSUE CO-EDITORS: DR. SEAN RUDAY & DR. CHYLLIS E. SCOTT
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CO-EDITORS' INTRODUCTION

DR. CHYLLIS E. SCOTT AND DR. SEAN RUDAY

Literacy in general is a diverse concept, while literacy instruction is even more diverse. Literacy instruction is also impacted by a myriad of everchanging policy demands, an on-going global pandemic, instructional practices, and technology advances. Additionally, literacy and literacy instructional practices include reading and writing for early literacy development, from learning to read to reading to learn, adolescent literacy, literacy across the disciplines, literacy development for preservice and inservice teachers, and adult learners. In this special theme issue of *Journal of Literacy Innovation*, it was our goal to explore inquiry practices and interdisciplinary approaches for literacy instruction. Such instructional approaches may refer to content-area and disciplinary literacy, inquiry-based literacy instruction, and other interdisciplinary instruction across and within K-12 disciplines, which encompass the preparation and teaching of preservice and inservice teachers.

In this special issue, the manuscripts are exemplary representations of innovative, engaging, and practical interdisciplinary approaches for literacy instruction for all levels of learners and educators.

In the first manuscript, “*The Most Me*”: Place and Community Cultural Wealth for Financial Literacy Learning by Leah Panther, Natasha Ramsay-Jordan, Laura Eby, and Lasha Lalana focuses on financial literacy and a community-based summer program for youth that brought together interdisciplinary community, school, and university educators in math, economics, and literacy.

Next, *Getting to the Root of Reading Intervention for Upper Elementary* by Dr. Courtney Dilgard and Dr. Tracey S. Hodges, provides context for recent changes in literacy instruction and research (i.e., science of reading and code-based instruction), in response to these changes the authors explored the extent to which an explicit and systematic morphology-based intervention impacted students’ sub-lexical, lexical, and supra-lexical reading abilities in grades three through six.

In *Supporting Foundational Literacy Skills through Interdisciplinary Studies* by Hailey Wolfe, Katherine A. Ayers, MS, and Robyn A. Pennella, MPH, the authors engaged kindergarten students in The *What do Humans Need to Survive?* learning module. This inquiry-driven, interdisciplinary learning module that integrates science, English language arts, mathematics, and social studies concepts, provides opportunities for students to engage with multiple modalities to help them make sense of their world. Through an exploration project, the aim was to understand the limitations and possibilities of interdisciplinary learning in supporting kindergarten students’ foundational literacy development.

In the next manuscript, *Interdisciplinary Multimodal Literacies Instruction in Remote and Hybrid Settings Amidst the COVID-19 Pandemic: Perspectives from Two Elementary School Teachers* by Qi Si and Dr. Julianne Coleman, using the Technological and Pedagogical Content Knowledge (TPACK) theoretical framework, the authors focused on two elementary teachers' perspectives on how they use multimodal tools to support students' literacies skills and their self-efficacy of such tools in cross-disciplinary teaching during the COVID-19 pandemic.

In *Increasing Preservice Teacher Self-efficacy for Strategic Think-Alouds in Literacy Instruction* by Dr. Tracey S. Hodges and Dr. Sharon M. Pratt, the authors sought to determine if one method for instructing preservice teachers on the design and use of effective think-alouds would increase their self-efficacy for writing instruction.

The last manuscript in this special issue is *Preparing the Next Generation of Mathematics and Science Teachers: Connecting Disciplinary Content to Literacy Through Experiential Learning* by Chyllis E. Scott, Matthew Albert, Diane M. Miller, Franklin S. Allaire, and Katlyn Cox. In this study preservice teachers' lesson plans and reflections, both contextualized through field trip experiences (i.e., art museum and recycling center), were used to examine their knowledge of content-area literacy and disciplinary literacy.

Special Theme Issue Editor Biographies

Dr. Chyllis E. Scott is an associate professor of education at the University of Nevada, Las Vegas in the Department of Teaching and Learning. She has authored publications focused on her research interests in content-area and disciplinary literacy, academic writing, and mentoring practices for pre-service and in-service teachers and students in higher education.

Dr. Sean Ruday is a professor and program coordinator of English education at Longwood University. He has written sixteen books on literacy instruction, all published by Routledge Eye on Education. Sean is a co-president of NCTE's Assembly on the Teaching of English Grammar and is particularly interested in inclusive and equitable writing and grammar instruction.

“THE MOST ME”: PLACE AND COMMUNITY CULTURAL WEALTH FOR FINANCIAL LITERACY LEARNING

**LEAH PANTHER
NATASHA RAMSAY-JORDAN
LAURA EBY
LASHA LALANA**

Abstract

Financial Language and Literacy is a community-based summer program for youth that brought together interdisciplinary community, school, and university educators in math, economics, and literacy. Using critical participatory action research methodologies framed by disciplinary literacy, place-based pedagogies, and community cultural wealth, we ask: What disciplinary literacy practices within place-based financial literacy education sustain cultural wealth? Within identified disciplinary literacy practices, youth communicated complex understandings of community cultural wealth in three ways: (a) spatial history as navigational wealth, (b) familial resources for past, present, and future identity development, and (c) developing disciplinary identities and community memberships rooted in place. There are implications for classroom-based educators and educational researchers to root disciplinary literacy pedagogies within place based and historical understandings of community to challenge disciplinary literacy practices that reflect historic patterns of privilege and power.

“The Most Me”: Place and Community Cultural Wealth for Financial Literacy Learning

Blinking against the hot, afternoon sun, I (Leah) motioned across the street where ten youth turned to look. “In 1956, that building that says PNC Bank? That was built and it was the very first bank in this entire area,” I began, “It had \$337,000 in assets. Any guess what that translates to today?” Brandon Mark, a rising senior, whips out his phone cuing up an inflation calculator to deliver the response: \$3.5 million. I continued,

As the very first local bank, they let people get loans entirely on credit. So people would come to them and say, ‘Hey, I have no money to put down, but I wanna buy or build a house.’

The youth continued to walk along the sidewalk, towards a local coffee shop, our destination for the day.

And they [the bank] would say, ‘Okay, here is \$50,000, but you have to pay us back eventually. And you can go build a house as long as it’s here in Tucker, but we have two other stipulations. One you can only get your building material from Cofer Brothers down the street.

They crane their necks backward towards the building by the railroad, towards the Cofer Brother’s maroon and red sign Laura, a high school history and economics teacher, is pointing out.

And two, you can only buy your cement from TUCCO, a cement company that was right here in Tucker. So in a matter of only 10 years, they were able to make the biggest jump in population that Tucker has ever seen. They went from, 1950, the population was 3,315. . . by 1960 it was 22,214 people. So we saw this 560% growth in population, all because that bank was willing to give people loans on credit, and build the wealth of TUCCO and the Cofer Brothers.

I finish as we arrived at our destination, and the conversations immediately became overlapping—two youth considering if that’s the same Cofer Brothers the library is named after, others chatting excitedly about who we were meeting: the Vice President of Organizational Financial Wellness and certified women’s business advocate from PNC Bank, and others craning their necks to see if they recognized anyone in the coffee shop. Lasha, a local business owner and community math educator, wins the unofficial competition, exchanging hellos with half the people seated around the café.

As we settled around a long table waiting for the youth to interview the financial literacy expert using their self-written questions, we shared a look that said “maybe this program is going to work.”

Within this article, we share the results of a community-based summer program for youth that brought together interdisciplinary community, school, and university educators in math, economics, and literacy. Titled “Financial Language and Literacy”, the program was designed through a community cultural wealth model (Yosso, 2005) where financial literacy was connected to personal, family, community, and generational wealth beyond financial income alone (Andrews et al., 2020). Adding to existing literature on culturally responsive financial literacy education (FLE) (Tisdell et al., 2013), this study further explores how place-based FLE connects community histories, wealth, and literacies (Zeamer, 2021) and asks: *What disciplinary literacy practices within place-based financial literacy education sustain cultural wealth?*

Theoretical Framework

This work uses disciplinary literacy to understand language and literacy practices within financial literacy and economics (Moje, 2007; Shanahan & Shanahan, 2008), place-based pedagogies to understand how literacy practices are shaped by and shaping local communities (Grunewald, 2003; Sánchez & Honeyford, 2021), and community cultural wealth to foreground the assets of communities as curricular resources (Yosso, 2005).

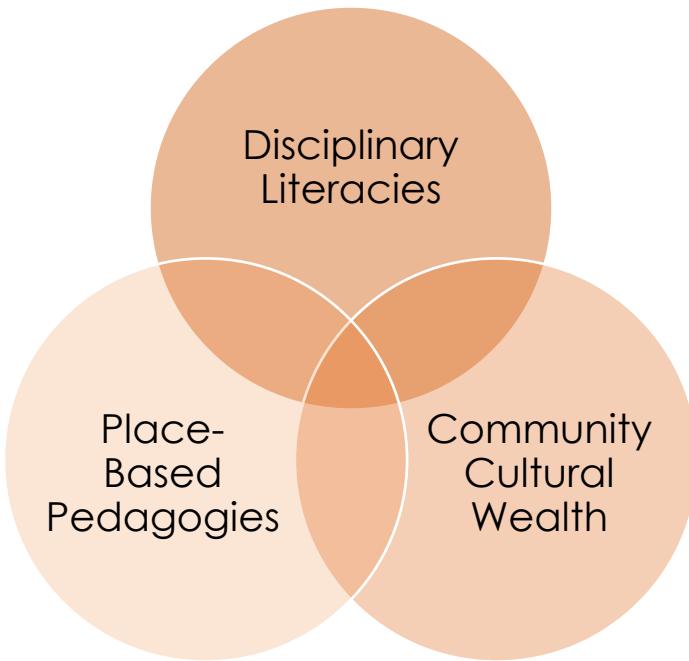


Figure 1. Theoretical and Conceptual Framework.

Disciplinary Literacy

Disciplinary literacy is a pedagogical approach to adolescent literacy instruction in which each discipline is understood as a subculture with its own texts, knowledge base, and ways of constructing knowledge (Moje, 2007, 2008; Shanahan & Shanahan, 2008). As a discipline constructs knowledge, it creates structures of power and access that exclude outsiders (Dyches & Gunderson, 2021; Moje, 2008; Moje et al., 2004). Thus, learning in a content area is an act of identity work; learners are not seeking static knowledge of content, but seeking community membership within the discipline (Kleve & Penne, 2016; Moje, 2015) by learning the beliefs, norms, practices, and behaviors that reflect membership within the cultural group (Gee, 2014). Therefore, disciplinary literacy is a pedagogical approach of apprenticing adolescents into the discipline's knowledge and the production of that knowledge so they are able to critically question and challenge the knowledge (Dyches, 2018; Moje, 2007, 2015). Within this work, we view our youth participants as collaborative, capable community members with full access to question and create knowledge within the discipline of economics and personal finance (Moje, 2008).

Place in Financial Literacy and Economics

Financial literacy education (FLE) is viewed as a way to combat, “higher levels of debt, lower credit scores, less wealth accumulation, and poor retirement planning” (Neuberger et al., 2021, n.p.) and is associated with positive health outcomes and a higher quality of life (James et al., 2012). However, participants’ experiences with FLE can lead to consumer overconfidence due to the oversimplification of personal responsibility within a complex economic system (Berti et al.,

2017), particularly when FLE is disconnected from intentional theories of change and the local community where financial and economic decisions are rooted (Collins & Holden, 2014). In fact, popular approaches to FLE have mixed effectiveness for three core reasons. First, many community-based financial literacy educators may come to the work with deficit ideologies about the learners that can create self-fulfilling prophecies (Engelbecht, 2008). Additionally, existing economics and financial literacy textbooks used in school-based coursework, “tends to be single-voiced which gives the impression of consensus in the discipline. . . [and] provide a model of literacy practices which contradict many of the literacy practices of the discipline of economics” (Paxton, 2007, p. 123). Finally, FLE for youth has historically lacked direct access to financial institutions and local economies to apply theoretical learning in practical ways (Williams et al., 2011). Any attempt to reap the positive benefits of FLE in schooling systems is dependent on creating a pedagogical approach that connects financial literacy practices to place-based communities.

Critical place-based pedagogies foreground “a narrative of local and regional politics that is attuned to the particularities of where people actually live. . . and trends that impact local places” (Grunewald, 2003, p. 3). Such an approach denies that curriculum can be “placeless” and connects learning to geographic *space*, and metaphorical and metaphysical *place* creating community belonging for those historically marginalized and erased (Haddix, 2020). Ultimately, space and place coexist and are constructed through interactions embedded with power and identity (Helfenbein & Taylor, 2009). We use the lenses of place, power, and identity to describe how community is constructed, co-constructed, and re-constructed throughout the study as a curriculum (Howard, 2018), particularly how this place-based curriculum is constructed through disciplinary language and literacy practices (Ozias & Pasque, 2019).

Community Cultural Wealth

Disciplinary literacy drove the instructional design of this study, while place and community cultural wealth drove the curricular design. Yosso’s (2005) theory of community cultural wealth explicitly names and defines the various capital, or resources, that lead to wealth beyond monetary gain. In the context of place-based financial literacy education in multiracial and multilingual communities, this means including cultural, aspirational, familial, social, navigational, resistant, and linguistic capital alongside conversations about income (Yosso, 2016). This will result identifying, naming, and describing disciplinary literacy practices that support FLE while expansively considering the community and the community’s cultural wealth as pedagogical resources (Sánchez & Honeyford, 2021).

Methodology

This project is part of the ongoing work of the Linguistic Justice Collaborative, a larger grant funded program that seeks to identify, design, and sustain community language and literacies to equip culturally and linguistically diverse youth to participate in their communities. This work took place in multiracial, multinational, and multilingual community within a large metropolitan area noted substantial economic growth due to its recent successful cityhood movement within the past decade. Following a community needs assessment to identify existing language and

literacy resources and learn more about opportunities families wanted for summer literacy programming, Financial Language and Literacy was noted as a “hot topic” for many community members. Particularly, to support youth in the community to build personal and generational wealth through entrepreneurship and investing. Leah, as a language and literacy educator and scholar, sought out interdisciplinary community-based experts to create a place-based team that could meet the community identified need. This included Lasha, a community math educator, Laura, a high school economics teacher, and Natasha, a math teacher educator. While the project team collaboratively created the vision and structure of the program’s design, youth participants were recruited from the local community to be co-researchers as part of a critical participatory action research design (CPAR) (Efret Efron & Ravid, 2019).

The term *critical* within the name refers to the equity-oriented aim of the work, *participatory* to the collaborative, dialogic process with participants to identify the problems and solutions inherent within the research questions, *action* the tangible change anticipated to result from the study, and *research* to the empirical, iterative, and cyclical process of planning, acting, observing, reflecting, and re-planning with participants (Table 1) (Kemmis et al., 2014). We asked: *What disciplinary literacy practices within place-based financial literacy education sustain cultural wealth?*

Table 1.

Our Youth Participants and Co-Researchers

Self-Selected Pseudonym	Age	Grade Entering	What they want others to know about them
Easton	12	7 th	Black man
Yuchi	12	8 th	Biracial female, musician, and artist
Mya	14	9 th	Black Christian female from a middle class, single parent household. A leader.
Sheldon	14	9 th	White Venezuelan who is bilingual (Spanish and English), an atheist, and lesbian. Nonbinary (she/her)
Thomas	14	9 th	White cis-gendered male
Jane	14	9 th	Bengali Muslim woman who is an American resident. Multilingual (Bengali, Arabic, and English) and a cat mom
Jawanza	15	11 th	Black male and basketballer
Valeria	16	College	Latina
Roxey	17	12 th	African American girl
Brandon	17	12 th	Mexican male, Catholic, and Bilingual (English and Spanish)
Mark			

Data Collection

The learning environment’s design followed a routine pattern within the community-based setting. Each of the ten daily sessions held across two weeks began with an artifact-based

discussion with participants to identify problems related to economics and financial literacy; for example, considering an overlay of maps tracking home values and the race of residents (Diaz, 2020). Then, small groups of the ten youth participants, aged 12 through 17, designed a way to investigate what the discussion revealed, such as meeting with a realtor to ask questions or completing a walking tour to map single-family and multi-family dwellings. Next, youth participants led the investigation, noting patterns or solutions. Finally, each day ended with participants sharing their findings to compare, contrast, and synthesize their knowledge into implications, such as revising their personal financial literacy goals, developing curricular resources for schools, or modes to disseminate information to their families and communities.

During this process, data was collected through audio recordings to identify disciplinary literacy practices (Patton, 2014), photographs of locations, curricular resources, and youth created texts to gather examples of community as curriculum (Paris & Winn, 2013), and daily semi-structured interviews with youth participants (Seidman, 2006). Finally, all documents created, curated, or selected by youth participants to represent the local economy, financial literacy goal setting, decision making, or behavioral change were collected (Patton, 2014).

Data Analysis

Daily sessions were transcribed, representing nine days or 41 hours of programming. The primary investigator completed level one descriptive coding using in vivo and gerund codes on transcripts of semi-structured interviews and exit interviews (Elliot, 2018). These codes were condensed to identify missing terms for the level two provisional codebook (Miles et al., 2018). The codebook was developed using the theoretical framework and guided the coding of all interview transcripts, excerpts of programming identified within field notes and analytic memos, and youth created documents. Within each code cluster, the researchers asked analytic questions to determine emergent findings (Miles et al., 2018). Once identified, level three thematic coding was completed on the same documents to check their validity (Saldaña, 2014).

Findings and Discussion

Over the course of the program, youth participants co-constructed disciplinary literacy practices leveraging local residents, businesses, and community places as the curriculum for exploring economics and financial literacy. This included financial literacy scavenger hunts, interviewing residents and business patrons, hosting panels of experts, and walking history tours, such as the one described in the opening vignette. Throughout the identified disciplinary literacy practices, youth communicated complex understandings of community cultural wealth tied to the place-based component of the learning environment in three ways: (a) spatial history as navigational wealth, (b) familial resources for past, present, and future identity development, and (c) developing disciplinary identities and community memberships rooted in place.

Spatial History as Navigational Wealth

On the first day of the program, youth participants walked through the community education center. Covering the walls were maps, diagrams, tweets, and quotes gathered about and from local community members with financial literacy advice and connections to the local economy

(Figures 2, 3, and 4). Sheldon calls it “the wisdom wall” noting “there was a lot of good stuff in there.” The wisdom of the local community was gathered from community members, printed out, and posted on a painted wall. This was a traditional approach to representing community knowledge in school settings: gathering artifacts and knowledge, and re-presenting the knowledge stripped of its original place and context. However, this was just day one: over the next two weeks the urban¹ city’s sidewalks, streets, and businesses would become the living curriculum for the financial literacy program. Each day, youth participants left the traditional community education building to walk in the local community, an opportunity to understand the space and its embedded histories. Sheldon explained:

it all goes back to a walk because. . . I could see. . . the history in, in the buildings here in [the city], and I could learn more about it and I could see like, yeah, the history of everything.

Jane agreed with Sheldon, noting, “We learned about financial literacy, obviously, but we learned about all these buildings. . . They were really old and we were just getting to know like the history and the stories behind every single one of them.”



¹ We use the term urban to refer to densely populated geographic areas marked by extremes of socioeconomic difference and home to racial, ethnic, linguistic, and other forms of cultural diversity (Emdin, 2020; Milner, 2012).

Figures 2 and 3. Part of the wisdom wall of community financial literacy knowledge



Figure 4. Youth pulling from the wisdom wall during activities

The geographic space of the community held a place-based history that, once uncovered, provided resources for understanding financial literacy. Luke explained one of these lessons:

One thing I learned is that the history of certain areas, it can cause certain things to happen still to this day. Like when we were talking about how it's different between the housing... and the race group in that area. How um, that that area has the least income because people kept selling to their own race back when that was the law. And so it kind of stayed down, kind of stayed lower income than other areas because other areas were predominantly White, which caused that. Basically, that was all history and community and finances.

Luke explains the history of communities, such as housing covenants, led to modern day economic access and lack of access, as well as impacts on generational property wealth.

Sheldon, Jane, and Luke are explaining navigational capital, or, “skills in maneuvering through social institutions... not created with Communities of Color in mind” (Yosso & Burciaga, 2016, p. 2). The youth participants co-designed a financial literacy program where the navigational capital was not decontextualized skills, but literally tied to physical navigation of the geographic place. From this perspective, the youth participants were able to understand how the place’s historic spatial design had been constructed over time to exclude, marginalize, and erase racial and ethnic identities and, in turn, how modern histories provided examples of inclusion, centering, and joy. Jane described walking through the community and being surprised that “everyone was really nice”, “wanted to talk to us”, and “they’re very enthusiastic”. As a Bengali Muslim, she did not anticipate seeing so many businesses owned by other West Asians and Muslims, as well. Jane realized she has the potential to start her own real estate career within the community. She shared her excitement about a Muslim operating a barbershop next door to a Christian owned coffee shop, pointing it out as a multicultural example of “the legacy I want to leave behind when I am gone”.

During disciplinary literacy investigations into financial literacy education, youth participants drew from the spatial histories of the community as resources for actualizing navigational

wealth. The space and its histories were sources of knowledge that shaped how youth navigated their community based on past histories. However, youth joyfully looked forward to future realities as they sought to sustain the navigational capital actualized by others within their community.

Familial Knowledge and Becoming

For youth within the program, community as a geographic place with a shared history was part of navigational capital youth drew from to understand economics and financial literacy. This can further be understood as familial capital or, “cultural knowledges” within families and sociocultural communities that pass down a “sense of community history, memory, and cultural intuition” (Yosso & Burciaga, 2016, p. 2). Familial wealth was identified within interactions dependent upon place-based learning, and was leveraged by youth to make sense of their own personal identities within financial literacy decision making. Sheldon recalled the same discussion Luke described previously:

when he [Luke] was talking about how the races differed in the community, and how much like they get paid and how they get treated, that kinda like hit me because I didn't know about that stuff. . . I could see myself in it because, just, stuff that has happened to me and my family.

For Sheldon, the racial history of the community and its modern-day impact was a larger narrative of her own family unit; understanding the history of the place helped her explore how her own familial memories were a part of the larger community’s stories. The knowledge became accessible through ongoing conversations with community members embedded in community places. Brandon Mark agreed, “you’re connected with it [the community] knowing a little bit more than your history,” he explained, pointing out communities carry histories larger than a single person’s memory. He motioned to the busy streets around him, “It looks like a timeline almost of where it was at, to where it is now.”

Finding ways to connect personal identity to a larger community’s familial capital also worked in the other direction for youth. Mya commented on the different “vibes” between community places, “seeing how people interact in different, uh, areas”. She explained her particular love of two shops within the community, “because that’s where I felt like most, like the most me at.” She explained:

I think they’ve [the stores] better helped me define myself. . . when I got [sic] in the store, I saw the art on the wall. I’m like, what is this place? And then I just walked further in was like, okay. I feel like me here. I feel like this store could describe who I want to be in the future . . . I feel like it better helped me understand who I want to be.

The familial capital of the community’s history helped Sheldon and Brandon make sense of their own identities, and how they contribute to the present-day understanding of the place. Further, Mya demonstrates how this familial knowledge is also future oriented; as the memories and material resources of a place can help define future identities, a point she again summarized:

I feel like, do I feel like what is important to me is knowing myself . . . and I feel like the shops and the places that we went and the things that we talked about really helped me decide, like where I want to go in the future with my financial decisions. So I know now that maybe I want to . . . volunteer, maybe for a nonprofit. And all that stuff in the past will affect my financial decisions.

Mya clarifies the connection between familial knowledge stored in the “shops and places we went” and interactions such as “the things we talked about” influenced her personal becoming around “financial decisions” and “knowing myself.”

Disciplinary Identities and Community Membership

Moje’s (2007, 2008, 2010, 2015) corpus of work defines knowledge creation as central to disciplinary literacy. Particularly, the power of disciplinary literacy pedagogies as, “a form of critical literacy because it builds an understanding of how knowledge is produced in the disciplines rather than just building knowledge in the disciplines” (Moje, 2008, p. 97). The argument calls for a balance of learner and disciplinary contexts:

The task of literacy education, relative to the goals of learning the discourses and practices of the discipline, then becomes one of teaching students what the privileged discourses are, when and why the discourses are useful, and how the discourses and practices came to be valued. (Moje, 2008, p. 100-1)

Disciplinary literacy pedagogies from this framing reveal *what* is privileged within a disciplinary discourse, *when* it is privileged, and *why* it is privileged. Within the place-based financial literacy education program, youth participants co-constructed financial literacy knowledge using the capital of the local economic community: this resulted in youth identifying with the discipline of economics and the place where economic knowledge is constructed.

Disciplinary Identities

Throughout the program, youth were apprenticed into the existing knowledge production of economics and personal finance, ultimately increasing their access to these disciplinary identities. For example, Sheldon appreciated meeting a local realtor because

she was explaining everything how well we needed to do to like, get a house and stuff. And that really grew in on me because I actually learned something. Well, that I needed to know for like my whole life, because like, I need that knowledge to actually know what I'm going to do, like in general.

Similarly, Jane enjoyed meeting with a local banker who made investment decisions on new entrepreneurial ventures because

she was there to help us and like, just for our future you know? . . . I just really liked how people were coming to help when it's, you know, like, so they can help us know what decisions to make in the future.

Mya agreed the knowledge and, “advice from each person that we talk to” was a valuable experience, “because they have gone through life more than I have. So they have things that they, they have experienced in life that they can teach me.”

The youth participants used the disciplinary experts’ knowledge to begin making their own decisions about economic engagements and personal finance, or translate that knowledge into personal financial literacy practices. Mya explained:

a lot of people were like telling us how different financial choices . . . that we make in the past can help us in the future. Like the shop that we went to the, with the car. We found out like they paid this much, but the other place paid higher because maybe there, they can get our car fixed, uh, better than the other one could. So that could affect our decision, uh, in the future.

These practices were not just future oriented, as several participants signed up for a debit card at a local Credit Union. Knowledge was being routinely translated into personal financial literacy practices as they increasingly saw themselves as agentive financial experts.

Youth participants also came with existing knowledge and financial literacies. Valeria had worked three different jobs, including a current position at a coffee shop. Yuchi had begun tutoring; a job Jane was also going to begin in the fall. Brandon Mark worked up to 40 hours a week throughout the summer in his family’s business, invested in cryptocurrencies with the supervision of his adult brother, and had an interest in entrepreneurship. While he did not self-identify as an investor, economist, or future financial planner, it was a future career he was interested in. Given Brandon Mark’s existing passion for the discipline, he found interactions with financial professionals the most influential part of the program:

It was interesting to have someone . . . who knows a lot about finance. And also being able to like, hear them talk about certain things that I’ve heard about . . . that I didn’t know. It was like, cause you only know so much on the internet. So hearing it from someone that worked at a bank really helped me like, okay, these are good sources to learn. It’s like further, further reinforced the ideas that I had.

The conversations with experts helped clarify and expand his existing knowledge, providing unique access into the discipline’s knowledge and literacy practices; a common sentiment shared by participants in interviews and through their growing economic vocabulary and financial decision making.

However, disciplines are professional communities, and becoming an expert within a disciplinary community extends beyond knowledge of the content and literacies valued in the discipline. It also includes access to the behaviors, beliefs, and norms of the discipline (Gee, 2014). Brandon Mark noted engagement with financial and economic experts within their professional environments opened up access to features of disciplinary identities that cannot be accessed in a traditional school setting. “You get to see how they dress themselves,” he explained, “Body language. Present themselves. So having that type of details in it when it’s like, speaking about finance kind of helps sell the image of it”. For Brandon, understanding the

clothing, body language, and overall image of someone who works in finance was essential to learning what it means to be an investor, economist, or financial planner.

Community Membership

While Brandon Mark and other participant comments demonstrated a pattern of disciplinary identity development over the course of the program, even more routine were the ways youth constructed, co-constructed, and re-constructed an identity as a community member.

For Jane, the real-world experiences helped prepare her for future decision making, “when we budgeted . . . because we would, we were making some tough decisions”. She recalled not having enough funds to cover both cat surgery and a car repair during one budgeting activity, “I wanted my cat to live. That was a priority, so how you’re seeing the things that you love.” These decisions were not just focused on self, but on how individual choices affect larger economic systems within the local community. Luke explained the program, “it’s taught me the people later in my life will be impacted by those financial decisions, but not really now because I’m not at a point where I’m making life changing financial decisions.” While Luke saw this community membership as growing over time, Mya viewed the community membership as an already-present reality that will continue into the future:

at first, when we first started, I didn’t really want to leave a legacy behind, but now . . . even though I might not be alive to see like my legacy go on there, there are still going to be other people that can take that legacy and build on my name, like that shop [family run Indian restaurant]. It’s a family job. So clearly, that’s their legacy. They’re still going, and it’s still progressing.

Whether making financial decisions to prioritize a pet, considering the implications of those decisions on future generations, or building an economic multigenerational legacy, the participants viewed themselves as community members: individuals engaged in the local economy through their personal financial decisions.

“Put Them in Their Communities”: Concluding Thoughts

Financial literacy education within the broader conception of disciplinary literacy is identity work: apprenticing youth not just into financial and economic careers, but as citizens in local communities, creating local economies, and interacting with larger financial systems (Dyches, 2018; Moje, 2008). The place-based design of the Financial Language and Literacy summer program used the youth participants’ local community as the pedagogical vehicle where the identity work would occur, and resulted in observable growth in the disciplinary knowledge, literacies, and community memberships that shape a discipline’s professional community. Furthermore, rooting all literacy practices within the context of community and place-based knowledge, participants grew in disciplinary identities that were interconnected with community membership.

Considering implications for classroom-based educators, it is important to note that the geographic place of a community-based program will provide different affordances than a traditional classroom. However, the access to disciplinary identities, literacies, and knowledges remains intact. Dyches (2022) explains students, “do not necessarily enter classrooms with knowledge of how systems of power work in ways specific to the discipline, or that the seemingly neutral discipline is actually a product of—and tool that perpetuates—power, privilege, and marginalization” (p. 76). Financial literacy, economics, and all disciplinary educators are not neutral in their pedagogies: leveraging a disciplinary literacy pedagogy is apprenticing the learners into an existing discipline, and therefore an existing system that reflects societal divisions of power, privilege, and marginalization. This work demonstrates disciplinary literacy pedagogies connected to histories of place move learners towards critical consciousnesses about disciplinary communities as well as local place-based communities. We continue our collaboration, working to translate the place-based summer program into traditional schooling spaces and encourage future research into critical disciplinary literacies that leverage place-based pedagogies to understand how this relationship translates across disciplinary communities.

Additionally, community as a geographic place with a shared history became the central material resources youth drew from to understand economics and financial literacy. This is in opposition to traditional single-voiced personal finance textbooks (Paxton, 2007) and positioned the community and its members as valued assets within financial literacy curricularizing (Yosso, 2005). This work found the familial capital of the community’s history, navigated through place-based pedagogies, supported present-day navigation for the youth participants. In particular, facilitating participants’ abilities make informed present-day decisions and growing joyful future-oriented understandings of themselves as financial literacy and economic decision makers. Additional research within rural, suburban, and other urban areas with diverse demographics will further capture how community wealth and histories can be leveraged within FLE curriculum.

The importance of building strong relationships between school and community cannot be overstated. Therefore, aligning students’ learning experiences about financial literacies in ways that foster authentic school-community connections is significant. The youth participants were asked what their recommendations were for financial literacy and economics educators and responded overwhelmingly to maintain the school and community connection. Mya said simply, “put them [learners] in their community.”

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GETTING TO THE ROOT OF READING INTERVENTION FOR UPPER ELEMENTARY

**DR. CORTNEY DILGARD
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Abstract

With the recent resurgence of the science of reading and code-based instruction, morphology has received less attention than phonics even though previous research has shown morphology instruction benefits students' reading skills, especially in the upper elementary grades (Bowers et al., 2010; Carlisle et al., 2010; Goodwin & Ahn, 2010; Reed, 2008). The present study used a cluster randomized design to investigate the impact of a morphology intervention protocol on striving students' sub-lexical, lexical, and supra-lexical reading skills in grades three through six ($n=56$). Results show the intervention statistically significantly impacted students' sub-lexical and lexical skills on the following measures: (a) morpheme identification, (b) rehit task, and (c) word attack. These findings support the use of morphology intervention with striving students to improve word recognition skills. The authors offer practical, actionable steps teachers can take to effectively teach morphology skills in the classroom.

Getting to the Root of Reading Intervention for Upper Elementary

National Assessment of Educational Progress (NAEP) results show 65% of fourth graders are reading below the proficient level (NCES, 2020). In response, the literacy field has seen a resurgence in the science of reading within early elementary grades (PK-3) focusing on code-based instruction (Ehri, 2020). However, this focus has mainly targeted phonics instruction. Somewhat absent from the current science of reading discussions, code-based instructional practices, and the National Reading Panel Report (2000), is the topic of morphology, which research has found beneficial to upper elementary readers. Goodwin (2016) defines morphology as "the system of rules that govern how units of meaning are combined to form words" (p. 92). Although research has found morphology interventions support positive reading outcomes, there is little guidance on how to best teach students this skill (Fishley et al., 2012).

The Carnegie Council for Advancing Adolescent Literacy (2010) discusses how increasing word complexity can be challenging for adolescent and pre-adolescent readers. For our purposes, we are defining this age group as students aged nine through 12, or grades four through six. When students decode multimorphemic words, they incorporate more skills and stamina than when reading one-syllable words, which they can use when encountering unfamiliar or discipline-specific terminology. Besides word reading, students' vocabulary knowledge becomes increasingly important in middle grades (Harris et al., 2011). As students enter upper elementary,

more texts include complex, content-specific academic vocabulary (RAND Reading Study Group, 2002), so vocabulary understanding becomes a factor that impacts comprehension. For example, science texts include more complex vocabulary than other content areas (Barr et al., 2012).

Kearns and Whaley (2019) contend beginning in fifth grade, more than 90% of the new words students encounter in text are multisyllabic, for which advanced knowledge of morphology is needed. Morphology instruction has been noted to improve a variety of literacy skills, such as decoding, spelling, vocabulary, and comprehension (Bowers et al., 2010; Carlisle et al., 2010; Goodwin & Ahn, 2010; Reed, 2008). Several researchers have emphasized the need for additional studies utilizing morphologically based interventions to identify effective morphology teaching strategies and implementation models and to measure impacts on different types of striving students and reading skills (Apel & Diehm, 2014; Brimo, 2016; Harris et al., 2011).

The Present Study

The present study incorporated a cluster randomized design to investigate the impact of an explicit and systematic approach to morphology instruction for striving readers in upper elementary grades (3-6). Findings from this study extend what scholars and teachers know about students who struggle with phonological processing and word recognition and provide alternative instructional pathways for helping students in upper elementary grades become more skilled readers. While synthesizing the research literature, we found approximately 30% ($n=22$) of morphology-focused studies conducted in the last ten years have been intervention studies, most of which conclude that morphologically focused interventions have positive impacts on students' reading abilities. One repeatedly cited future research need in this body of work is determining appropriate morphology teaching strategies and implementation models through intervention studies (Bowers et al., 2010; Brimo, 2016; Fishley et al., 2012).

Specifically, the present study explored the extent to which an explicit and systematic morphology-based intervention impacted students' sub-lexical, lexical, and supra-lexical reading abilities. We used these levels to explain the application of students' morphological knowledge. Sub-lexical application consisted of students identifying morphemes and their meanings. Lexical application consisted of students using morphology to build word level meanings. Supra-lexical application consisted of using morphology within a sentence or paragraph text to build meaning. Bowers and colleagues (2010) used these linguistic levels in a meta-analysis to analyze effects, but to our knowledge, a single study has not taken this combined approach. Therefore, the present study's research questions are: to what extent does a morphology-based intervention increase students' morphology awareness to improve reading skills at a: (1) sub-lexical level?; (2) lexical level?; (3) supra-lexical level?; and (4) What is the impact of grade level on students' rate of growth during a morphology intervention? Based on these results, the authors share practical applications for teachers.

Theoretical Framework

Theoretical frameworks associated with morphology revolve around how the brain breaks apart words, stores orthographic information, and retrieves morphemic meanings. Two commonly

cited theories include Dual-Route Theory and Triple Word Form Theory. Dual-Route Theory proposes two separate routes for reading words (Grainger & Ziegler, 2011). The lexical route is used when whole word orthography is linked to semantic knowledge, and the non-lexical route is used when students break words into parts before decoding and connecting semantic knowledge. Triple Word Form Theory contends students draw from knowledge of phonology, orthography, and morphology simultaneously. Because students can mobilize these different language structures to support decoding and spelling efforts, effective instruction in all three areas is critical. These theories provide the current foundation for understanding why morphology instruction is important and the process children use when reading morphologically complex words.

Literature Review

Many upper elementary teachers may lack the advanced knowledge for incorporating morphology instruction in the classroom; however, this area of research is also under-developed. In the following sections, we outline prior research including what the field knows about morphology instruction and the gaps that led to this study's design.

What is Morphemic Analysis Instruction?

Morphemic analysis is the ability to identify morphemes within an unknown word, connect meaning to those morphemes, and use that knowledge to correctly determine a word's meaning (Harris et al., 2011). This ability could have meaningful impacts for students who struggle to read and comprehend complex words. Through morphemic analysis instruction, students practice breaking words into morphemes (e.g., meaningful parts such as prefixes, suffixes, and roots) and using a graphic organizer (Helman et al., 2015) or strategy steps to support the process (Harris et al., 2011). However, very few studies provide guidance to teachers about how to teach morphemic analysis (Fishley et al., 2012), aside from a few isolated strategies. Guidance on fully developed instructional steps would greatly benefit teachers, especially those lacking in morphological knowledge.

Bowers and colleagues (2010) conducted a meta-analysis, investigating 22 studies focused on morphology instruction to provide insight into the effectiveness of morphology instruction and strategies. To calculate the effects for this meta-analysis, reading skill outcomes were categorized by linguistic layers. For the present study, we used these same three layers: (1) sub-lexical, (2) lexical, and (3) supra-lexical. Table one describes these layers, provides a definition, and lists the correlated reading skills.

Table 1*Linguistic Layers*

Linguistic Layer	Definition	Correlated Morphology and Reading Skills
Sub-lexical layer	Relating to word parts	morpheme identification, morpheme meaning knowledge, morphological analogies, connecting root word families (transparent and opaque)
Lexical layer	Relating to words and word-level meanings	word reading accuracy, spelling, vocabulary, morphemic analysis
Supra-lexical layer	Understanding beyond the word level - oral or written	syntactic awareness, comprehension

(Bowers et al., 2010)

The goal of morphology instruction is to transfer morphology knowledge from the sub-lexical layer to the supra-lexical layer and ultimately increase comprehension (Bowers et al., 2010). The present study will build on this knowledge by using a systematic approach to purposefully advance student knowledge from the sub-lexical to the supra-lexical layer during each intervention lesson.

What the Field Knows about Morphological Analysis and Instruction

The National Reading Panel Report (2000) brought to light the “big five” of reading; morphology was not a focus. The report only mentions morphology knowledge being beneficial for spelling and morphemic analysis as a strategy but does not deeply explore the topic. However, as more research has been conducted in the field during the last twenty years, researchers know more about morphology instruction. Some understandings the field currently has about morphology instruction include: (1) its positive impact on students with dyslexia and striving readers; (2) its support of vocabulary learning which is directly related to comprehension; and (3) its usefulness when integrated into other aspects of reading instruction.

First, emerging evidence suggests morphology instruction benefits students with dyslexia (Brimo, 2016; Kearns & Whaley, 2019). Students with dyslexia traditionally struggle with phonology (Snowling, 1995). Because reading instruction is heavily focused around phonology in the younger grades, this weakness will often impact student achievement in the K-3 grade setting. These phonological processing struggles can continue to impact learning as students mature and word family connections become more opaque as suffixes and prefixes are added (Kearns & Whaley, 2019). Focused morphological awareness instruction can support students with dyslexia to become more efficient readers and spellers by supplementing phonology weaknesses (Carlisle et al., 2010; Goodwin & Ahn, 2010; Kearns & Whaley, 2019).

Second, morphemic analysis can help to improve students' vocabulary which is critical because of its connection to reading comprehension. Because roots can be connected to word families, morphology learning can have a large impact on students' understanding of multiple words. For example, the root *astro* could help support both decoding and understanding of the following words: astronomy, astrology, astronaut, astronautical, astrophysics, and atmosphere. By providing instruction on targeted, high-utility morphemes, practitioners can enhance students' vocabulary knowledge, thereby impacting comprehension (Carlisle et al., 2010; Goodwin & Ahn, 2010; Washburn & Mulcahy, 2019).

Third, while questions are still emerging from the field about how to best instruct students in the area of morphology, recent research has shown morphology should be integrated into other reading instruction (Bowers et al., 2010). Crosson and Moore (2017) were successful in integrating Latin root instruction during academic vocabulary lessons with English Language Learner students in middle and high school. Harris and colleagues (2011) integrated a morphemic analysis intervention into a general English class with high school students and found students made significant gains in morphological analysis skills over a comparison group. Morphology could be a beneficial component of core instruction for all students.

What Does the Field Need to Know about Morphological Analysis and Instruction?

Several topics for future research remain in the area of morphology. Some of these topics include teacher knowledge, additional theories and models of how morphology connects to other areas of literacy, detailed intervention steps to inform classroom teachers how to teach morphemic analysis, and larger sample sizes that give insight into specific student populations (Brimo, 2016; Carlisle et al., 2010; Fishley et al., 2012; Washburn and Mulcahy, 2019). By conducting additional research, we can move to impact classroom-level instruction.

Teacher knowledge of morphology is a key topic for future research. Washburn and Mulcahy (2019) conducted an exploratory study that indicated teacher candidates lacked knowledge of key morphology terminology which could mean teachers are not teaching this skill as often as the standards suggest. For this reason, the present study will use classroom teachers and provide professional development. Additional research could help create professional development and guide changes in teacher preparation programs to address this concern. In addition, researching an explicit intervention model could help bridge gaps in current teacher knowledge by providing highly structured activities that build in complexity.

Additional theories and models of instruction could impact change in curricula. Carlisle et al. (2010) recommended "researchers place high priority on developing more complete models or theories of the relation of morphological awareness to other components of literacy development" (p. 481). By investigating these relationships and developing models to illustrate those relationships, we can support understandings in the field for the importance and interconnectedness of these literacy components.

Morphemic analysis has the ability to impact vocabulary, thereby impacting reading comprehension which is the goal of reading instruction; however, more research is needed to guide this instruction (Fishley et al., 2012). In addition, multiple researchers have recommended

future studies include larger samples since many studies have only included very small sample sizes (Brimo, 2016; Harris et al., 2011; Helman et al., 2015). By providing additional guidance on teacher knowledge, theories and models, and intervention strategies, researchers can help reach classroom-level instruction to impact student learning.

Therefore, combining these gaps in the current research, the present study measured the impact of a systematic protocol to build students' knowledge from the sub-lexical layer to the lexical, then the supra-lexical. This approach adds to the body of knowledge about instructional practices used during morphology instruction and intervention.

Methods

We used a cluster randomized sample design for this study with random assignment within grade levels. Eligible students were randomly assigned to either the treatment or comparison group for each grade level. The comparison group participated in business-as-usual (BAU), tiered reading instruction which consisted of targeted skill instruction from classroom teachers and school interventionists. These lessons focused on fluency, vocabulary, and comprehension. The treatment group received treatment five days per week, twenty minutes per day for six weeks. More information about the treatment is detailed below.

Participants

We acknowledge students in rural areas may have less access to print-rich environments, such as libraries, resulting in a stronger need for reading intervention. This population is also under-researched in the field of morphology instruction. Therefore, this study focused on rural students. A student sample from a Title I, rural, southeastern elementary school was used for this study. This sample may help researchers better understand the needs of rural students while also showing how an upper-grade morphology intervention can complement K-3 reading efforts. Students in grades 3-6 who were pre-identified as striving readers, based on below-level scores on the school's benchmark assessments, were approached for study participation. A total of 56 students returned consent and assent forms to participate in this study. A total of twelve teachers consented to participate by delivering the intervention lessons. Table two shows the details of each grade level's participation.

Table 2

Participant Grade Levels

Group	N
Control	25
Treatment	31
Third Grade	24
Fourth Grade	14
Fifth Grade	5
Sixth Grade	13

The school's demographics include 59% White, 35% African American, 4% Hispanic, and 2% Asian students. The school is 50% female and 50% male, with a free and reduced lunch population of 53.5%. The school is situated in a medium-sized school district and is comparable to many rural schools in the southeast. This population is of special interest because as mentioned above, rural areas not only tend to have less access to libraries, but a more recent concern is rural communities' lack of broadband internet service. Over 20% of this school's population declared a lack of internet service in March 2019. This is a common challenge for rural students where broadband internet service is unavailable, thereby limiting online and digital literacy resources at home. As such, this sample captures a relatively average population for rural students elsewhere.

Intervention Procedures

The primary researcher developed an intervention protocol to be used for all intervention lessons. Teachers who provided instruction to treatment groups participated in a three-hour professional development session prior to teaching the intervention. Due to the participating school's schedule, multiple intervention groups took place concurrently. By training the teachers to teach the intervention, we created an authentic intervention implementation. Morphemes were selected from Vocabulary Through Morphemes (Ebbers, 2011). A total of 47 high-utility morphemes were taught during the six-week intervention. Weekly intervention lessons included a combination of morpheme types with each lesson having a single semantic morpheme focus. Table three details the morphemes taught during the intervention.

Table 3

Intervention Morphemes

Lesson 1	Prefix dis-	Lesson 16	Prefix sub-
Lesson 2	Root aud	Lesson 17	Root spect, spec, spic
Lesson 3	Suffix -ly	Lesson 18	Suffix -al, -ial, ual
Lesson 4	Prefix in, il, im, ir	Lesson 19	Prefix inter-, mid-
Lesson 5	Root ped, pod	Lesson 20	Root dict, dic
Lesson 6	Suffix -er, -or	Lesson 21	Suffix -y
Lesson 7	Prefix non-	Lesson 22	Prefix de-
Lesson 8	Root bio	Lesson 23	Root port
Lesson 9	Suffix -er, -est	Lesson 24	Suffix -ness
Lesson 10	Prefix over-, under-	Lesson 25	Prefix trans-
Lesson 11	Root phon	Lesson 26	Root mit, mis
Lesson 12	Suffix -sion, -tion	Lesson 27	Suffix -less
Lesson 13	Prefix mis-	Lesson 28	Prefix super-
Lesson 14	Root scrib, scrip	Lesson 29	Root struct
Lesson 15	Suffix -able, -ible	Lesson 30	Suffix -ment

The intervention tasks moved systematically from sub-lexical tasks to a lexical task and ended with a supra-lexical task. By building through these linguistical layers in a systematic way, students' learning was supported, and we show morphological knowledge can be established systematically. Figure 1 demonstrates the systematic structure of this intervention protocol and its connection to the theoretical framework. The 20-minute intervention lesson plan contains the following activities listed in Table four.

Figure 1

Systematic Protocol with Theoretical Framework Connections

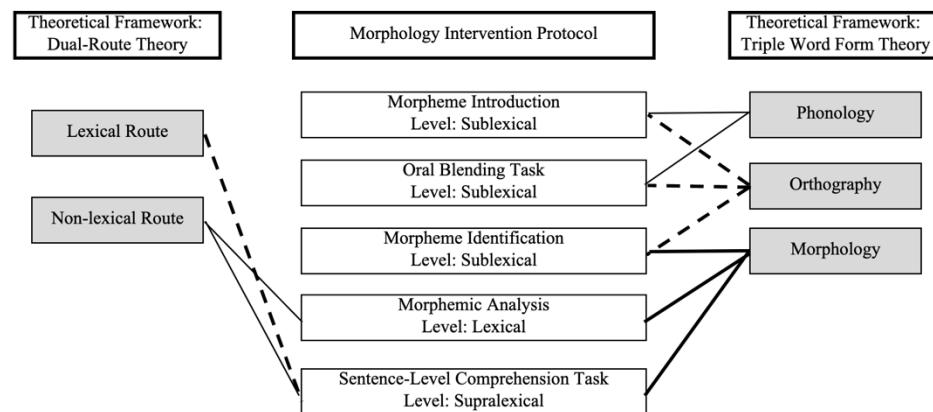


Table 4

Intervention Lesson Activities

Task	Time	Purpose	Sample of Materials
Morpheme Introduction	3 minutes	Introduce students to morpheme, type, and meaning.	Flashcards with morpheme on one side and meaning on the other for games
Oral Blending Task	2 minutes	Students will hear and blend the target morpheme with others to build a word.	Counters as manipulatives to slide for each morpheme while blending
Morpheme ID Task	5 minutes	Students will identify the target morpheme in printed words.	Printed words and pencils
Morphemic Analysis Task	5 minutes	Students will use knowledge of the target morpheme to develop meanings for words.	Graphic organizer (Fishley et al., 2012) or morphemic mapping chart
Sentence-level Comprehension Task	5 minutes	Students will complete CLOZE sentences with multimorphemic words containing the target morpheme.	Printed CLOZE sentences and pencils

Measures and Data Collection

We administered pre- and post-test assessments to all study participants at the onset and conclusion of the study. Measures were identified by three levels: sub-lexical, lexical, and supra-lexical to provide insight into which linguistic layers are most influenced by the intervention (Bowers et al., 2010). Table five describes the measures used during this study and gives a justification for their use.

Table 5

Pilot Study Measures

Measure	Linguistic Layer	Justification	Reliability
Rehit Task	Lexical	Measures student knowledge of a given morpheme and their ability to combine morphemes to determine word-level meaning (Apel & Diehm, 2014).	Researcher designed measure (Apel & Diehm, 2014)
Morpheme Identification Task	Sub-lexical	Measures a student's ability to identify morphemes within a word, accounting for orthographic changes in different word contexts (Apel & Diehm, 2014).	Researcher designed Measure (Apel & Diehm, 2014)
Relatives Task	Lexical	Measures a student's ability to connect inflected and derived word forms (Apel & Diehm, 2014).	Researcher designed Measure (Apel & Diehm, 2014)
WRMT-III Word Attack	Sub-lexical	Measures students' word-level decoding through application of alphabetic and syllabication knowledge.	WRMT average reliability between .81 and .99.
WRMT-III Oral Reading Fluency	Supra-lexical	Measures a student's reading fluency and accuracy	WRMT average reliability between .81 and .99.
WRMT-III Passage Comprehension	Supra-lexical	Measures a student's reading comprehension	WRMT average reliability between .81 and .99.

*Woodcock Reading Mastery Test III (WRMT-III)

Data Analysis Procedures

A cluster randomized sample design was used to determine if the intervention's impact was statistically significantly different than the business-as-usual (BAU) comparison group instruction. The dependent variables in this study were morphology awareness, morphemic analysis, word identification, fluency, and comprehension. Morphemic awareness was measured from the Morpheme Identification Task. Morphemic analysis was determined from the Rehit task, and syntactical morphemic analysis was determined from the Relatives Task. Word identification was measured with the WRMT-III word attack measure. Oral reading fluency and passage comprehension were measured with the respective WRMT-III measures. To answer this study's research questions, results are discussed in relation to the linguistical layers: sub-lexical, lexical, and supra-lexical. One-way analysis of variance (ANOVA) tests were conducted to measure differences between treatment and comparison groups. A two-way ANOVA test was conducted with grade level as an additional independent variable. SPSS software was used to conduct all statistical analyses (IBM, 2020).

Results

One-way between-subjects ANOVA tests were conducted to compare the effect of the morphology intervention on students' linguistical skills in treatment and BAU conditions. Table six shows these results.

Table 6

Linguistical Level Results

Measure		Sum of Squares	df	Mean Square	F	Sig.
Morpheme ID (sub-lexical)	Between Groups	21.368	1	21.368	15.061	<.001**
	Within Groups	76.614	54	1.419		
	Total	97.982	55			
Rehit (lexical)	Between Groups	42.305	1	42.305	13.624	<.001**
	Within Groups	167.677	54	3.105		
	Total	209.982	55			
Word Attack (lexical)	Between Groups	81.178	1	81.178	5.324	0.025*
	Within Groups	823.375	54	15.248		
	Total	904.554	55			
Relatives (supra-lexical)	Between Groups	2.434	1	2.434	1.837	0.181

	Within Groups	71.548	54	1.325		
	Total	73.982	55			
Oral Reading Fluency (supra-lexical)	Between Groups	0.525	1	0.525	0.025	0.875
	Within Groups	1132.457	54	20.971		
	Total	1132.982	55			
Passage Comprehension (supra-lexical)	Between Groups	11.978	1	11.978	1.115	0.296
	Within Groups	580.147	54	10.743		
	Total	592.125	55			

These results show a statistically significant effect on students' sub-lexical and lexical skills. At the sub-lexical level, students' morpheme identification skills significantly improved with the morphology intervention. At the lexical level, students significantly improved on the rehit measure and the word attack measure. These results indicate students' supra-lexical skills were not significantly impacted by the morphology intervention as compared to the BAU intervention. However, we recognize that the morphology intervention only included one task at the supra-lexical level. These results indicate that additional practice at the supra-lexical level may be needed for this transfer of knowledge.

A two-way ANOVA was conducted to measure the effect of grade level and the morpheme intervention on students' reading achievement. The two-way ANOVA revealed there was not a statistically significant interaction between grade level and the morpheme intervention on any of the measured reading outcomes. This indicates that these grade levels (3-6) were not a significant variable when considering the impact of this morphology intervention.

Discussion

The overall aims of this study were to examine the impacts of an explicit and systematic morphology intervention protocol based on the aforementioned three linguistical layers. To our knowledge, this is the first morphology instructional protocol developed to systematically support students to build morphological skills through these layers. Results showed significant effects at the sub-lexical and lexical layers. No significant effects were found at the supra-lexical layer. In the following sections, we discuss the type of students who may benefit from this type of morphology instruction, morphology instructional resources, supra-lexical needs, practical applications for the classroom and directions for future research.

Students Who Benefit

This study's sample targeted upper elementary striving readers. For students who leave early elementary grades and continue to have difficulty decoding words, specifically more complex, multimorphemic words, morphology instruction could be especially helpful. Oftentimes, upper elementary reading instruction prioritizes vocabulary and comprehension. Upper elementary intervention programs may revert to phonics and syllable type instruction to support word recognition skills. While that instruction is helpful for reading in general, these results indicate morphology may be another route for improving striving readers' abilities. This finding aligns to previous research findings that skilled readers rely on morphology knowledge and application when reading (Zhang, 2016). These results indicate striving students' sub-lexical and lexical reading skills were statistically significantly impacted by this focused morphology intervention. Since this is not a typical approach to reading instruction or intervention in upper elementary grades, literacy leaders and teachers may want to explore ways to incorporate this type of explicit and systematic morphology instruction for these students.

Morphology Instructional Resources

This intervention protocol uniquely supported students through the linguistical levels by first introducing a morpheme and then having students orally blend words with the lesson's target morpheme. We found it helpful for students to use manipulatives, like counting chips, during this part of the lesson to make the morphemes more concrete. Next, students connected the morpheme's orthography by identifying it within words. For the lexical level, students used a morphemic analysis map to apply their morpheme understanding and approximate words' meanings. Finally, for the supra-lexical level, students used the multimorphemic words from the lesson to fill in blanks in CLOZE-style sentences.

Typical instructional materials for morphology offer little teacher support and very limited student practice opportunities. For teachers, morphology requires additional content and pedagogical knowledge of the complexities and layers of the English language. For students, in order to move beyond the typical worksheet-level knowledge, multiple practice opportunities are needed to apply morpheme knowledge at increasingly higher levels. Teachers will most likely be required to create and develop these opportunities for their students since few morphology-focused instructional resources exist.

Supra-lexical Needs

These results show our intervention protocol did not statistically significantly impact students' reading skills at the supra-lexical level: syntactical morphemic analysis, fluency, and comprehension. In this protocol, we only included four CLOZE-style sentences in each lesson. Students had more opportunities for practice at the sub-lexical and lexical levels during this intervention. This could indicate that students may require additional practice for applying morpheme knowledge at the supra-lexical level. Participating teachers provided feedback that students were able to identify morphemes from the intervention with their core reading book and apply that knowledge for understanding. Students may benefit from a passage level application to increase supra-lexical effects.

Practical Application

Morphology instruction can be used to improve students' sub-lexical and lexical skills. Teachers wanting to implement morphology instruction in the classroom can take four actionable steps to improve students' reading skills: (1) select high-utility morphemes, (2) teach morphemes' meanings and rules, (3) create tasks for students to use morphemic analysis skills to determine word meanings, and (4) offer application-level practice to support transfer of knowledge. In the sections below, we offer practical advice for implementing these four steps.

Teachers should select high-utility morphemes that students are likely to encounter when reading upper elementary texts. A combination of prefixes, roots, and suffixes should be introduced to help students learn the application of each morpheme type. Teachers can focus on derivational morphemes, morphemes that change a word's meaning, over inflectional morphemes, morphemes that change a word's tense or quantity, for a bigger impact on vocabulary skills. Ebbers (2011) and Lane and colleagues (2019) suggest morphemes that students are likely to encounter while reading. Teachers can use the morphemes listed in table three to plan effective morphology instruction.

Teachers can explicitly teach morpheme meanings and rules to support students' understanding for morphemic analysis. For example, when adding a vowel suffix, students will need to know common vowel suffix rules like consonant doubling, dropping silent letter e, or changing letter y to an i. When students understand these rules, they are better equipped to identify morphemes within complex words. Teaching a single morpheme meaning can have a big impact on the number of words a student can learn. For example, knowing the meaning of the morpheme *archy* can help students understand words like monarchy, anarchy, and patriarchy.

Once students learn a morpheme, they should practice morphemic analysis skills to apply morpheme meanings and infer definitions for novel words. Teachers should have students break multimorphemic words down by identifying the prefix, root, and suffix. Next, students should assign a meaning to each morpheme and then combine those meanings to infer the complex word's definition. Once students can carry out these steps independently, they are equipped with skills to attack novel and complex words while reading. Teachers can use the tasks in this study's intervention protocol that are detailed in table four as a beginning point for planning morphology instruction.

Last, teachers should model and support morphemic analysis while reading content-area texts. Planned morphemic analysis practice with vocabulary lists is beneficial but supporting students to analyze complex words in context while reading will help students transfer this knowledge. Students should use these skills to build meaning while self-monitoring comprehension.

Implications

As students move from *learning to read* in the early elementary grades into *reading to learn* in upper elementary grades, applying independent reading skills become more important. Upper elementary and middle-grade students are required to read complex texts with content-area vocabulary for comprehension. Previous studies have shown that students who are able to understand morphologically complex words also demonstrate higher reading comprehension (Lawrence et al., 2021). This study's findings show that even a six-week morphology

intervention is beneficial for improving striving students' sub-lexical and lexical reading skills. Literacy leaders and educators can use this information to guide lesson planning efforts to provide explicit and systematic morphology instruction.

This study provides teachers with two critical pieces of information for planning effective morphology instruction: a list of high-utility morphemes and a sequence of instructional tasks. The morphemes listed in table three represent a balanced selection of prefixes, roots, and suffixes that can be used across upper elementary grades. The instructional tasks described in table four can be used to systematically support students' morphology knowledge through the different linguistical levels. Providing teachers with the tools to implement this instruction in the classroom is a critical part of bridging theory and practice.

Limitations and Future Directions

To identify striving students for this study, we relied on the participating school's use of their adopted reading benchmark assessment. Students who scored below grade level and were placed in tier two intervention groups were invited to participate. The field could benefit from a broader sample to determine if these same results can be achieved with different types of students.

In addition, teachers only received a three-hour professional learning session prior to teaching this intervention protocol. Even though the lead researcher was present and attended the study's intervention lessons on a regular basis, teachers frequently asked questions about particular morphemes. For future studies, additional teacher training and support could be helpful. During this study, COVID-19 related absences were experienced, as was the norm for the school year (2021-2022). Finally, in future research, this intervention protocol could be expanded to include additional supra-lexical practice opportunities for students.

Conclusion

During this study, we examined the impact of an explicit and systematic morphology intervention protocol on striving students' reading abilities in grades 3-6. Significant effects were observed on sub-lexical skills, morpheme identification ($p<.001$), and lexical skills, rehit tasks ($p<.001$) and word attack ($p=.025$). No significant effects were observed at the supra-lexical level for syntactical morphemic analysis, fluency, nor comprehension. Overall, these results show striving students benefit from a systematic approach to morphology instruction that includes opportunities for application and practice at each linguistical layer.

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SUPPORTING FOUNDATIONAL LITERACY SKILLS THROUGH INTERDISCIPLINARY STUDIES

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Abstract

Engaging kindergarten students in the practices of science is one way to facilitate sense-making of the world around them. The *What do Humans Need to Survive?* learning module, an inquiry-driven, interdisciplinary learning module that integrates science, English language arts, mathematics, and social studies concepts, provides opportunities for students to engage with multiple modalities to help them make sense of their world. This manuscript explores how the learning module developed and/or expanded literacies through students' *All About Me!* projects. Through this exploration, we aim to understand the limitations and possibilities of interdisciplinary learning in supporting kindergarten students' foundational literacy development. We found that the learning module was able to develop literacy skills in four major ways among kindergarten students: Use of Details to Communicate Information, Connections to the Texts, Use of Symbols and Labels, Use of Book Construction. Interdisciplinary learning modules incorporating the practices of science appear to be a promising mode for young learners to expand literacy skills.

Keywords: Interdisciplinary learning, early elementary, foundational literacy, practices of science, science education

Supporting Foundational Literacy Skills through Interdisciplinary Studies

Engaging kindergarten students in the practices of science to explore phenomena relevant to their lives is one strategy for helping children make sense of their world (Larimore, 2020). Yet, many early elementary school educators struggle to find time for science due to literacy and numeracy often taking precedence (Banilower et al., 2013). A popular approach for overcoming this challenge is the development of interdisciplinary learning modules that integrate science and social studies with reading and writing activities (Pentimonti et al., 2020; Strachan & Block, 2020). Similar to the ways in which foundational reading and writing tenants can enhance science inquiry, engaging in authentic science inquiry can enhance literacy skills in a synergistic way (Pearson et al., 2010). A meta-analysis of research on integrated literacy and content-area (science and social studies) instruction in elementary school showed that integrating learning modules have the potential to enhance vocabulary and reading comprehension while also developing science and social studies content knowledge (Hwang et al., 2021). These integrated

approaches have also been shown to increase positive attitudes towards both science and reading in students (Bradbury, 2014).

At the kindergarten grade level, interdisciplinary approaches should focus on connecting science and social studies to reading and writing practices that build foundation skills that support emergent readers. These include phonemic awareness (the awareness that spoken words are made up of individual sounds), knowledge of high frequency sight words, and the ability to decode words by translating a word from print to speech (National Institute of Child Health and Human Development, 2000). Brown (2014) asserts that all children can develop a strong foundation for literacy when “given opportunities to engage in purposeful, meaningful language and early print activities” (p. 46). Connecting foundational skills to the study of phenomena relevant to children’s lives provides such opportunities.

One way to introduce new or challenging phenomena to kindergarten students while also strengthening foundational literacy skills is through the use of a multiple text and picture comprehension framework. This framework argues that learners can utilize multiple sensory modalities to make sense of complex topics (Schnotz, 2012). Specifically, spoken text, written text, visual pictures, and auditory pictures can be integrated into a single or combined comprehension of a topic. Text comprehension is complementary to phonetic foundational literacy skills. Text and picture comprehension requires a learner to draw upon their prior knowledge that is stored in their long-term memory. This framework also allows students to pick and choose which sensory modalities work best for them. This can be especially useful to kindergarten students as they begin to make sense of the world around them while not possessing robust written comprehension skills. Previous research has argued this framework’s use when designing curriculum, particularly in the sciences – a discipline full of abstract concepts, to help students construct concrete knowledge and familiarity around abstract concepts (Opfermann et al., 2017; Hansen & Richland, 2020). Moreover, external representations reinforce the notion that science is a multimodal discourse (Beck & Nerdel, 2019).

As part of a larger, quality improvement study aimed at increasing the quality and quantity of science education within the kindergarten classroom, researchers and teachers collaborated to cocreate the *What do Humans Need to Survive?* learning module, an inquiry-driven, interdisciplinary learning module that integrates science, English language arts, mathematics, and social studies concepts. This learning module provides opportunities for students to engage with multiple modalities to help them make sense of their world, in line with the multiple text and picture comprehension framework. Part of the curriculum design process involved redesigning the common kindergarten *All About Me!* project by integrating common children’s literature with the practices of science to have students explore questions about who they are and what they need to survive. Curious about the influence of the interdisciplinary science learning module on kindergarten students’ foundational literacy development, we used data generated from the larger study to seek answers to the following questions:

1. What literacies are developed and/or expanded through the interdisciplinary science learning module?

2. What are the limitations and possibilities of interdisciplinary learning in supporting young children's foundational literacy development?

Exploration Into the Learning Module, *What do Humans Need to Survive?*

This learning module is text heavy with intentional ties to social emotional concepts set on a foundation of the seven scientific practices. Through this interdisciplinary approach, the students are introduced to the idea that all academic disciplines are interconnected and that they lend themselves back to literacy. In the learning module, the students are guided to create an *All About Me!* project, outlining their connection to family, friends, and shelter. Through creating an emotional connection to the topic and setting the purpose of the module, being components of survival, they then begin a deeper search. Students ultimately determine humans must stay physically and mentally healthy to survive. This learning module has four main lesson components; why do humans need families? Why do humans need friends? Why do humans need shelter? The module then concludes with a student-led investigation of interventions to stop the spread of germs. Connection is made across all three components by presenting science as a tool to help us care for the wellbeing of our families and friends through the prevention of spreading germs across the shelters where we live, learn, and play.

A first step in most lessons is an activity to gauge students' understanding of a topic before initial exploration. The learning module opens with a concept map to gather students' prior knowledge about the needs of humans to survive. Teachers gather students' thoughts on human needs and record them onto the concept map to refer to as a resource of student thinking. This visual map of students' thought process becomes an outline of the lesson progression throughout the module. Students are involved in how the module progresses as they can choose from the concept map the topics they want to explore further. Examples of students' responses are that human needs include food, water, shelter, other humans, and sleep.

A deep dive into the diversity of family dynamics opens with a read aloud of a nonfiction story *All About Families* by Felicia Brooks, which leads to a discussion of heredity and traits. As students are guided to examine the diverse families, they identify that a family is made up of two or more members who care for one another in a home. Students' thought processes and ideas are once again recorded on an anchor chart to solidify the learning. This non-fiction text opens the discussion of diversity as students compare and contrast graphics, in the text, of various family types. Students use illustrations to communicate and reflect on their definition of family, what it looks like and feels like to them, where they live, and how they celebrate. These illustrations are combined and added to a collection of artifacts to create their *All About Me!* project. The lesson ends with a consideration of what we can do when we meet new families by engaging with a fictional story, *Llama Llama Time to Share* by Anna Dewdney. The students identify the dynamics between the two families in the story, and how they interact. The students explain how the characters found a solution to the problem of sharing between Llama Llama and Nelly Gnu, opening the class to a discussion to create classroom norms for sharing with one another. This, in turn, begins a conversation about friends.

To segue into a study of friendships, students read aloud a nonfiction text, *All About Friends* by Felicity Brooks. During the readying, they are prompted to discuss diversity among individuals and how individuals are connected within our communities. The text helps students to identify types of friendships and how friendships are good for the overall health of individuals through social interactions. To examine healthy and unhealthy relationships, students read a fiction text, *Llama Llama and the Bully Goat* by Anna Dewdney. The story portrays a fictitious classroom in which students are in kindergarten. A student named Gilroy Goat is not following directions from the teacher and is also being mean to Llama and Nelly in the classroom and at recess. Through giving real life examples of activities and interactions students face each day, they are guided to point out the nice versus the mean interactions and what could be done differently. This activity is completed as a group followed by students joining the teacher in giving examples and in talking about how we should interact nicely. Students continue illustrating and recording their thoughts onto the next set of student book pages for their project, which are drawings of their friends, how they show they care for one another, and what a healthy relationship can look like.

After the emotional connection has been established through family and friends, students examine their need for shelter. In this lesson, students learn about different ways that shelters serve to protect humans from various elements. As part of this discussion, students make connections to the COVID19 pandemic and the need to keep our home and classrooms safe from germs through a fiction reading, *Llama Llama Home with Mama* by Anna Dewdney. In the story, Llama has to stay home sick while Mama Llama takes care of him. However, halfway through the book, as Llama begins to feel better, Mama Llama begins to feel sick. Using evidence from the text, students develop a model for how they think germs spread from person to person. Using this model, students are then asked to think about where germs might be growing in the classroom. Students then read a nonfiction text, *All About Germs* by Katie Daynes, to learn about different types of germs (e.g., bacteria, viruses, etc.) and use agar plates to test for germs on the surfaces of their classroom. After students gather their data, they use mathematical thinking to determine where in the classroom germs are growing. Once they have completed the investigation, students develop an intervention to prevent the spread of germs in their classroom, testing their intervention through a second scientific investigation.

How Literacy is Being Supported Through the Learning Module

Kindergarten is the year when foundational literacy skills are set. As an educator of young minds, I, Hailey, set intentional practices to deliver a systematic and methodical instruction of literacy. This module was taught in the beginning of our school year, the literacy skills embedded are to match beginning of the year kindergarten skills that students need in order to begin to achieve phonological awareness. This learning module includes multiple modalities for an educator to exemplify concepts of print in diverse texts, both fiction and non-fiction, to identify connections from text to pictures, and to produce rhyming words which lends itself to reading fluency development (Brown, 2014).

The use of the multiple texts and pictures in this learning module offers teachers the ability to model desired concepts of print skills. To practice these skills, the students themselves become

authors and illustrators while creating their *All About Me!* project. Concepts of print skills include identifying front cover, back cover, title, author, illustrator, title page, page numbers, as well as correct hold and determining the difference between pictures and written text. These skills are necessary to understanding the meaning of a text. Through methodical demonstration by a teacher during a read aloud, the students can glean those skills and begin to use them in their readings (Smolkin & Donovan, 2003). As students are creating their *All About Me!* project, they are reminded to act as an author or illustrator to match the illustrations to the text on the page and to use detail to tell the story as pictures can be read, as well as words, to create meaning. After all of the pages have been collected, they create a front cover and back cover for their book; they include the title, All About Me!, and add their name as the author and illustrator. The students combine the pages and are guided to bind them all together into a book.

There are fiction and nonfiction books among the aforementioned texts. Both types of texts include text and picture features yet support literacy development in different ways. Whereas fiction texts prompt an emotional connection as students explore learning concepts, nonfiction texts build vocabulary. The diverse texts used in this module include text features such as printed words, pictures or photographs, graphs, labels, captions, and tables as well as, headings and subheadings. The use of teacher modeling to decipher these text features can lead to students' comprehension of the main idea or the key details of the text as well as an increase in their ability to communicate ideas through illustrations. In early literacy, students are learning to communicate comprehension of a text effectively. Using multiple modalities, as set out by the multiple text and picture comprehension framework, facilitates students' comprehension and aids in their ability to communicate effectively. The previously mentioned story elements often include lesson vocabulary and their definitions that students need to learn to begin to make a solid understanding of the content. Teachers examine and model how to use these story elements for connections to learn and enhance vocabulary by recording them on a chart or adding them to a word wall. At this young age, students need to constantly learn new terms to develop their vocabulary. An enhanced vocabulary has been linked to a deeper understanding of diverse concepts (Ricketts et al., 2007; Senechal et al., 2006; Snow et al., 1998).

Illustrations and photographs reinforce a text as they work as a scaffold to guide the thought process. When a story is first introduced, especially in the younger grades, educators often send students' focus to the illustrations or photographs on the pages to aid in students' comprehension of the text. Educators model the skill of reading pictures early in literacy instruction to train students to identify text elements such as key details, characters, and setting. This task encourages students to think critically and make predictions about the story and draw upon multiple modalities to construct their own understanding. Students can demonstrate mastery of this skill in early literacy by using illustrations and photographs to retell what has happened within the given text to show comprehension. As previously mentioned, mastery of this skill can translate into students using illustrations that include specific details and settings to communicate as they might be unable to yet communicate using graphemes, the written form for individual sounds.

The foundation of phonological awareness rests on various abilities to hear individual sounds in words. An introduction to mastery of this skill is the use of rhyming words (Brown, 2014). The Llama Llama series by Anna Dewdney uses illustrations and text to tell the story of a young llama, his family, and his friends as they go through various life events in their community. The text in the story is made of stanzas of poetry which lends itself to students being able to predict upcoming words as they are listening to the ending sounds of the final word in the former stanza to predict the final word in the next stanza. During the read aloud lessons in the module, teachers make intentional pauses for the students to fill in the word at the end of the stanza. Teachers then make references to those rhyming words using visuals, anchor charts, or index cards, reinforcing the idea that they are rhyming words. The skill of rhyming begins with listening to sounds in words and determining if they rhyme. From there, it turns to producing rhyming words to make a given word. This skill teaches a student to listen to specific phonemes, sounds in a word, and isolate the sound to match it. Rhyming aids students towards mastery of phonemic awareness, the ability to segment, isolate, delete, or substitute sounds within words. This ultimately leads to fluency of reading.

The stories included in this module are presented to students through multiple readings. The first read of a text is an integral part of literacy development as it serves to model a fluent reader and fluency development is known to enhance literacy skills (Brown, 2014). A fluent reader reads with accuracy and prosody. They are not reading to decode; they are reading to comprehend. Thus, the first read of a text should be read cover to cover, including text elements, without stopping to ask questions or retelling, focusing on the overall story and the fluency of the reader. As a result, students gain knowledge of what a fluent reader looks and sounds like. During the second read of the story, however, the teacher pauses periodically to point out details, identify key details, or to ask questions about the text. In this way, students are encouraged to think more deeply about what the text is trying to communicate.

Study Design

This study was conducted using document analysis (Bowen, 2009) as a strategy for assessing evidence of literacy development in kindergarten students' *All About Me!* projects. In total, 43 *All About Me!* projects were included in this analysis. The study team, which consisted of the three authors of this manuscript, analyzed the projects by coding content into themes based on the research questions.

Evidence of Literacy Skill Development in the *All About Me!* Project

Analysis of the *All About Me!* projects yielded the following themes: Use of Details to Communicate Information, Connections to the Texts, Use of Symbols, and Use of Labels.

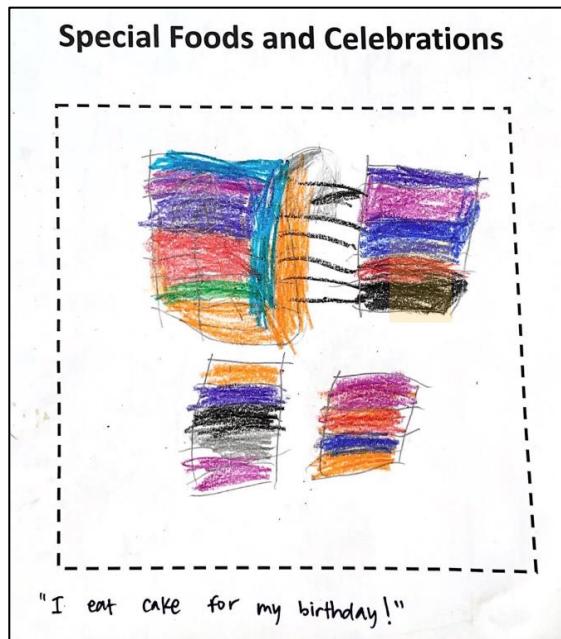
Use of Details to Communicate Information

Most students were able to use details appropriately to communicate information in their *All About Me!* books. This was most evident in the pages that asked them to draw an action or an activity (i.e., special food and celebrations, family activities) versus a relationship (i.e., healthy friendships) or portrait (i.e., self-portrait, family portrait). Yet, this was not true of all students.

For example, in looking at the drawings related to “Special Foods and Celebrations,” we can identify three illustrations that all communicate the action of eating cake. Yet, their ability to communicate this action differed significantly. Figure 1 shows an image illustrating eating a birthday cake. In the image, the use of lines between two parts of the cake clearly communicates the action of a slice of cake being removed from the whole.

Figure 1

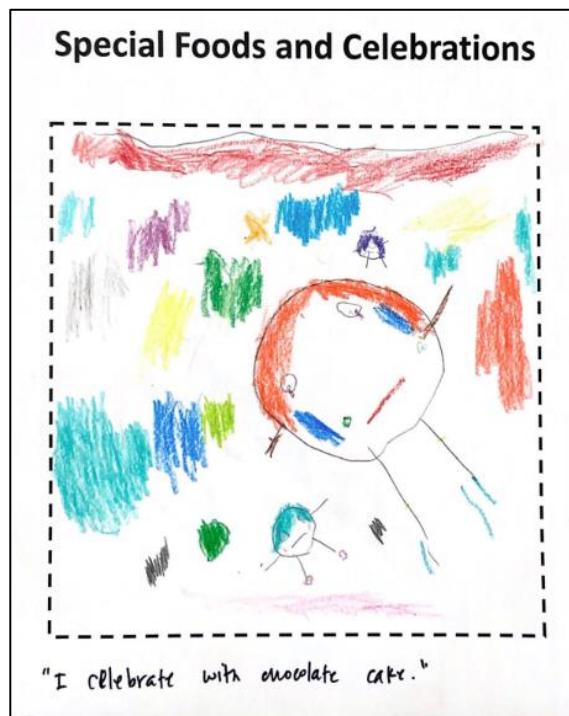
“I Eat Cake for My Birthday”



Combined with the presence of additional slices of cake that have already been removed, it is evident that the student is depicting the slicing of a birthday cake to be shared amongst the guests. In this instance, the student is clearly able to use details to communicate the desired action. Figure 2, on the other hand, provides an example of a drawing that provides a lot of details, but these details do not communicate the action of interest.

Figure 2

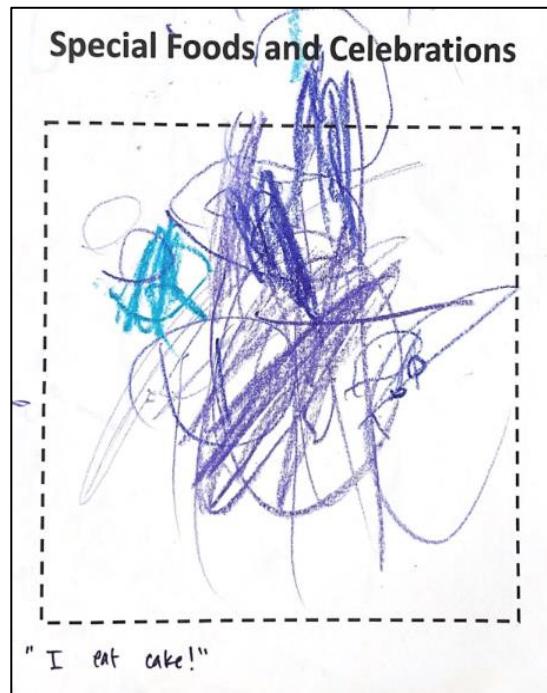
"I Celebration with Chocolate Cake"



Like the picture in Figure 1, this picture claims to be illustrating a celebration involving cake. Yet, the details in the picture illustrate a scene where a child is crying. While there is some evidence of a celebration (e.g., festive colors, party guests), there is no evidence that chocolate cake is involved in the celebration. Finally, Figure 3 provides no details that clearly connect to the idea of eating cake.

Figure 3

"I Eat Cake"

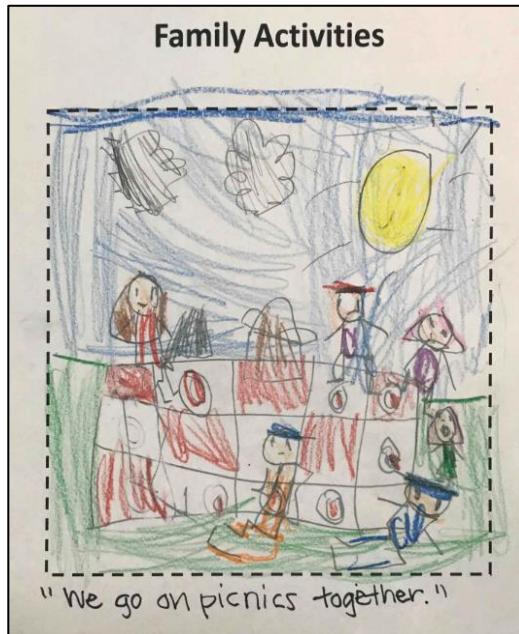


Connections to the Text

Many students were able to make direct connections to the text in their drawings, superimposing themselves into the illustrations in the books. For instance, Figure 4 shows an illustration of a family eating a picnic, which closely resembles the illustrations in the *All About Families* book that depicts various family activities, including a family picnic.

Figure 4

A Family Picnic



Similarly, students made social and emotional connections to the books, drawing illustrations that mirrored the settings and scenes described within the text. For example, Figure 5 shows an illustration of a young girl intervening in a situation where a student is being bullied. The setting of this image, with the tan ground, looks very much like the sandbox described in *Llama Llama and the Bully Goat*, where Gilroy Goat is bullying Nelly Gnu and Llama Llama.

Figure 5

Bully Prevention in the Sandbox



While most students made positive connections, expressing a desire to share or build healthy connections to friends, a few students expressed negative connections, expressing that they did not want to share or did not like friends. For example, Figures 6 and 7 are two illustrations that depict different responses to the lessons learned in *Llama Llama Time to Share*. In Figure 6, two little girls are sharing a doll, which is like the resolution of the story where Llama Llama and Nelly Gnu begin to share their dolls. In contrast, Figure 7 is an illustration of two human figures, one with a ball and the other without, and a caption that reads "I hate sharing."

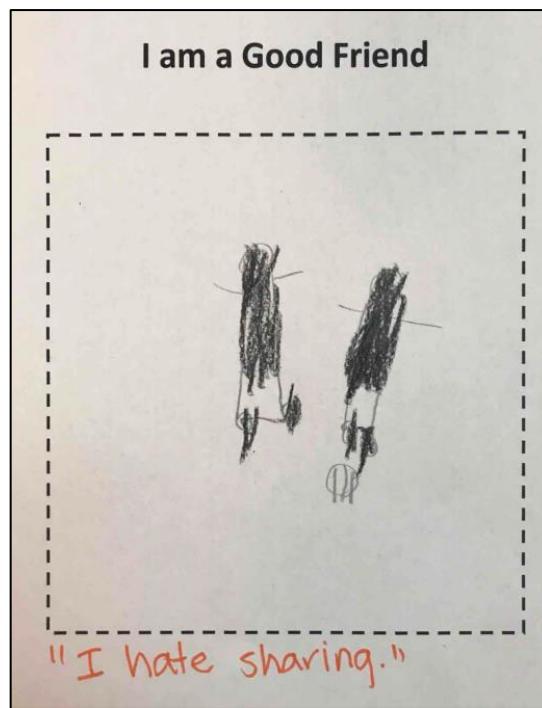
Figure 6

"We Share Our Dolls"



Figure 7

"I Hate Sharing"



Use of Symbols and Labels

While symbols and labels were not used widely across the projects, they were observed in a small subset of students. Symbols were often used to convey an emotion, such as with the use of hearts used to express love (Figure 8) and rainbows to express unity or belonging (Figure 9).

Figure 8

Use of Hearts to Express Love

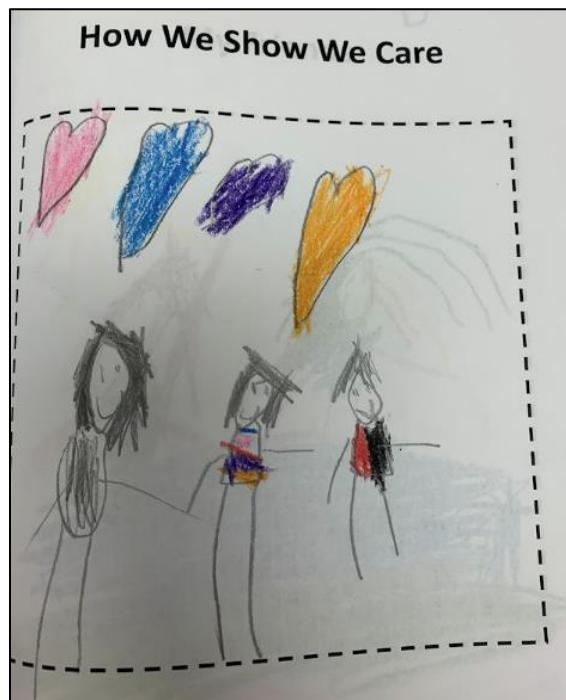
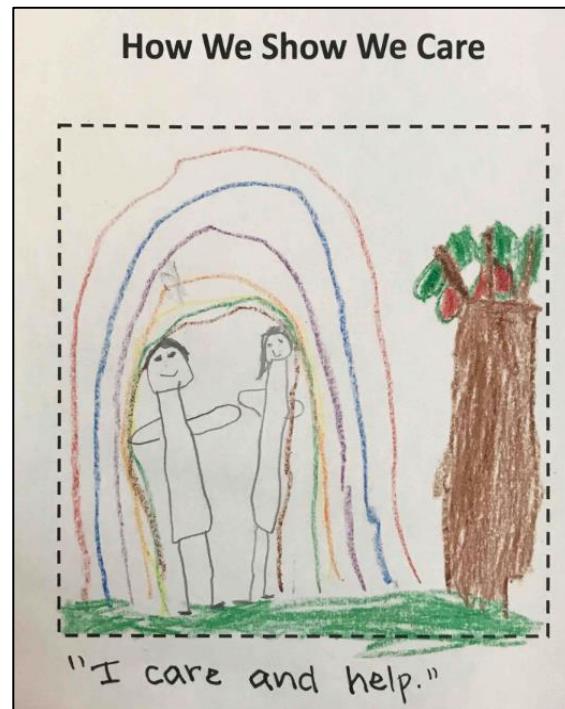


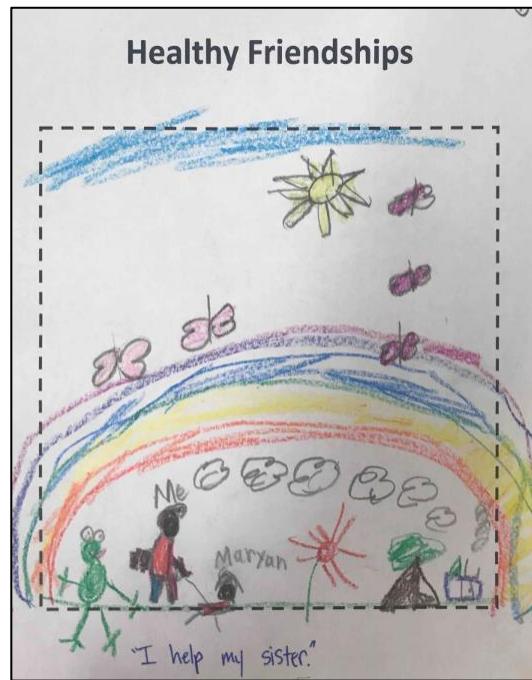
Figure 9

Use of Rainbows to Express Unity/Belonging



Labels, on the other hand, were most often used to name elements of the drawing. In Figure 10, for example, labels are used to identify the individuals in the illustration.

Figure 10
Use of Labels

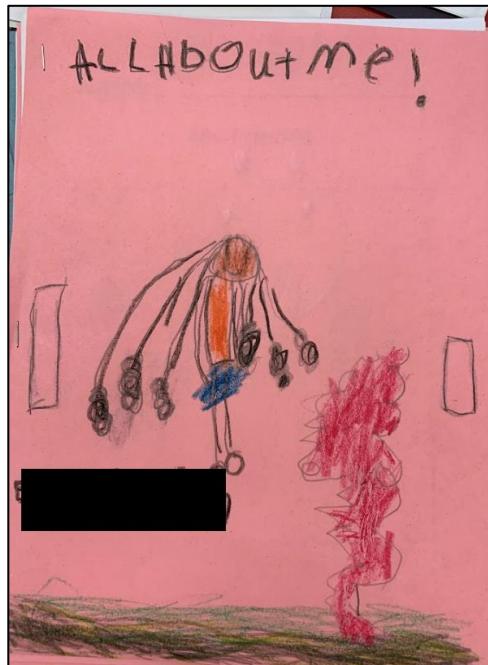


Use of Book Construction

A few teachers provided examples of the *All About Me!* projects that were assembled into books, complete with a cover page, title, author, and illustrator (Figure 11).

Figure 11

Completed All About Me! Book



Discussion

Analysis of students' *All About Me!* projects suggest that the learning module supports students in the development of literacy skills related to reading fiction and nonfiction texts using multimodal communication strategies. Specifically, students were able to use drawings and the cocreation of captions with their teachers to demonstrate the following literacy standards: CCSS.ELA-Literacy.RL.K2: *With prompting and support, retell familiar stories, including key details*; CCSS.ELA-Literacy.RI.K2: *With prompting and support, identify the main topic and retell key details of a text*; and CCSS.ELA-Literacy.RI.K5: *Identify the front cover, back cover, and title page of a book*. This use of multiple modalities allowed students to make sense of the complex concepts presented in the texts and connect their understandings to situations in their lives (Schnotz, 2012).

Throughout the learning module, students were asked to connect their learning from the literature and nonfiction readings to the pages of their *All About Me!* projects. This served as a form of retelling. Retelling involves using, in words or drawings, the comprehension of a text including the events, characters, and setting. This communication back to the teacher helps the students to retell the details in their drawings as they are making connections to the text. This module aided students in the development of this skill. This is evidenced through drawings where students superimposed themselves into the illustrations and cocreated captions with their teachers that

mirrored the text in the books read during the module implementation, such as in Figures 5 and 6. In addition, these drawings demonstrate that the students comprehended the lesson the story was trying to convey. Figure 5, for instance, depicts a human figure actively preventing bullying, a key element of *Llama Llama and the Bully Goat*. The setting of the picture appears to be a sandbox, which is the site where the bullying event takes place in the story. Here, the child has superimposed themself into the illustration from the text, but rather than illustrating a bullying event, has transformed the scene to illustrate the moral of the story; thereby, demonstrating their comprehension of the text. Similarly, students were able to use details to communicate the main concepts of the nonfiction texts and how they apply to their lives. This is evidenced in Figures 1 and 4, where students retold details from *All About Families* and transferred those details into a retelling through the pictures. This agrees with previous research demonstrating the impacts of literacy and content-specific instruction on comprehension (Hwang et al., 2021).

In addition to using the drawings to have students capture details to retell main concepts from fiction and nonfiction texts, some teachers leveraged the project to help students develop concepts of print by having students construct their projects into the form of a book. This indicates the potential of the learning module to expand students' literacy skills in new and creative ways. Future work will involve incorporating additional strategies for enhancing students' development of craft and structure.

Conclusion

Throughout the *What Do Humans Need to Survive?* learning module, teachers guide students to demonstrate comprehension of the main concepts learned through literature and nonfiction texts. Specifically, students are asked to draw on their learning from the texts and include them in their drawings for an *All About Me!* project. Document analysis of the *All About Me!* projects revealed that learning in the module expanded students' ability to use key details from texts to retell stories to communicate how the main concepts from the texts connect to their lives. This was accomplished through multiple modalities—drawing and cocreating captions with teachers. This suggests that interdisciplinary learning provides an exciting potential for expanding student literacy skills in ways that reinforce content-specific knowledge.

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INTERDISCIPLINARY MULTIMODAL LITERACIES INSTRUCTION IN REMOTE AND HYBRID SETTINGS AMIDST THE COVID-19 PANDEMIC: PERSPECTIVES FROM TWO ELEMENTARY SCHOOL TEACHERS

**QI SI
DR. JULIANNE COLEMAN**

Abstract

Multimodal literacies integrate different types of print-based texts and digital tools that play an important role in K-12 teaching and learning. This study focuses on two elementary teachers' perspectives on how they utilized multimodal tools to support students' literacies skills and their self-efficacy of such tools in cross-disciplinary teaching during the COVID-19 pandemic. This study is guided by TPACK theoretical framework and data collection consisted of qualitative semi-structured one-on-one interviews. The two teachers' perspectives about interdisciplinary multimodal literacies instruction are synthesized and analyzed into themes. Findings indicate that the utilization of digital tools provide convenience for the teachers in planning and management, but there are still challenges during remote or hybrid instruction such as the limitation of technology and insufficient linguistic support to students. The study shed light on how the current multimodal literacies instruction potentially impact future face-to-face classroom instruction.

Keywords: Multimodal literacies instruction; remote teaching; teachers' perspectives; teachers' self-efficacy.

Interdisciplinary Multimodal Literacies Instruction in Remote and Hybrid Settings Amidst the COVID-19 Pandemic: Perspectives from Two Elementary School Teachers

Multimodal "texts" (e.g., books, digital texts, multimedia presentations, songs, digital resources, websites, etc.) exist in integrating a variety of modes (e.g., visual, aural, textural, gestural, spatial, etc.) such that multimodal literacies articulate these modes to affect communication and literacy comprehension (Kress, 2000). In educational practices, different modes (e.g., print-based visual representations, digital apps, audios, videos, drawings, e-books, etc.) are used by K-3 teachers to support the learning and meaning-making experiences of young children and their overall comprehension of content, concepts and new knowledge (Shanahan & Roof, 2013;

Pantaleo, 2016; Yelland, 2018). Even though the use of digital tools is not new, the attention to online learning and the pedagogical practices used to teach students has increased due to the global COVID-19 pandemic. Given the inability to utilize face-to-face instruction in many classrooms across the world, many educational policy makers, researchers, teachers, and parents have questioned the impact of online teaching especially regarding teachers' pedagogical practices in the context of online learning (Boltz et al., 2021; Schwartzman, 2020). Since the spring 2020 when the COVID-19 virus began to spread, many K-12 schools in the United States (US) moved to fully remote or hybrid instruction necessitating the use of internet-based digital tools (e.g., Google apps, Zoom, Seesaw, ClassDojo) that requires the use of multimodal literacies practices (Lynch, 2020).

Furthermore, this shift resulted in unintended consequences that only exacerbates the present inequities and disparities related to students' educational outcomes across the US (Ladson-Billings, 2021; Schwartzman, 2020) compared to pre-pandemic contexts (Korkmaz & Toraman, 2020). Even more troubling is that these challenges may be more severe for lower grade level teachers because their students are young and may need more resources and supportive instruction when learning virtually. Additionally, according to the National Center for Education Statistics (NCES, 2020), in 2017 the population of English learners (ELs) in the US had grown to 10.1% of all students with an upward trend. Young ELs need access to equitable resources to support English learning from their teachers and family members in remote settings given their own limitations in both linguistic resources and cognitive competences (Sugarman & Lazarin, 2020). Another challenge is the accessible and affordable internet-based digital tools for rural area teachers to conduct instruction in remote settings, and their self-efficacy in remote teaching with multimodalities, which impact teaching effectiveness (Boltz et al., 2021; Schwartzman, 2020).

Although there are numerous research studies focused on multimodal literacies instruction in various settings (e.g., Boche & Henning, 2015; Cappello & Walker, 2016; Hill, 2014), more studies need to investigate teachers' perspectives and self-efficacy of integrating multimodal literacies into online-based instruction. Teachers' beliefs come from individual prior experiences and knowledge; the beliefs are important for conducting educational inquiry that includes the accurate understanding of conceptualizations and certain content knowledge (Pajares, 1992; Richardson, 1996). In other words, teachers' self-efficacy of multimodal instruction is based on their previous knowledge and experiences of integrating multimodal literacies in classroom instruction. Additionally, teacher self-efficacy is believed to be one salient motivational characteristic to affect instructional quality (Burić & Kim, 2020). Therefore, explore teachers' perspectives regarding multimodal literacies instruction would be helpful to understand how teachers' instructional practices can support students' learning with technologies-based and digital tools.

For the current study, we are interested in exploring how elementary school teachers think and believe about their multimodal literacies instruction to support students' learning in remote settings and shed light upon how such instructional practices can influence their future classroom

instruction. Therefore, the purpose of the study is to employ an interview methodology to explore the elementary school teachers' perspectives and self-efficacy about interdisciplinary multimodal literacies instruction during the COVID-19 pandemic in one rural area of a southeastern state in the US. This study aims to answer the overarching research question: What are the elementary school teachers' perspectives and self-efficacy about multimodal literacies instruction in remote and/or hybrid settings?

Theoretical Perspective

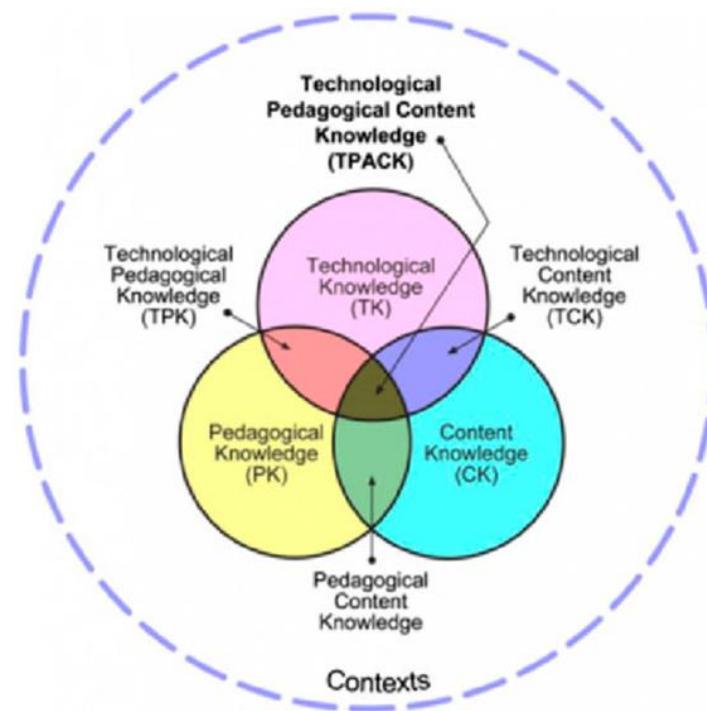
This study draws upon the theoretical perspective of the Technological and Pedagogical Content Knowledge (TPACK), which asserts a complex relationship between teacher knowledge utilizing technology and pedagogical content knowledge exists—both essential to teacher self-efficacy and expertise.

Technological Pedagogical Content Knowledge (TPACK)

Mishra and Koehler's (2006) TPACK framework is rooted in Shulman's (1986) construct of "pedagogical content knowledge" (PCK) that asserts a complex relationship between content and pedagogy exists thus teacher knowledge is based in both. The TPACK framework extends Shulman's concept of PCK by adding the role of technology in teacher knowledge and methods that best deliver content in ways that support learning for all students. The TPACK framework identifies three primary forms of knowledge: Technological Knowledge (T), Pedagogical Knowledge (P), and Content Knowledge (CK) (see figure 1). The framework supports the interconnected nature of pedagogical content knowledge and technology, which is central to our work of supporting K-3 teachers in effectively teaching multiliteracies instruction. Given the TPACK framework, teachers' technological pedagogical content knowledge is an area of knowledge that must be encouraged, developed, and supported especially given the current climate associated with COVID and the increased use of online learning in P-6 settings. In our view, preparing K-3 teachers in TPACK should not be an afterthought but rather at the forefront of teacher education practice (Hodges et al., 2021).

Figure 1

Technological Pedagogical Content Knowledge (TPACK) (Mishra & Koehler, 2006)



From some research perspectives, teacher beliefs are generated from their knowledge and prior experiences and are taught to influence students' achievements (Mishra & Koehler 2006; Bandura, 1997). Teachers' attitudes and beliefs are closely related to their pedagogical content knowledge in the specific areas and their instructional practices (Shreiner & Dykes, 2021). If teachers have lower levels of confidence in their knowledge and abilities regarding the multimodal literacies instruction then these beliefs may lead to teachers' negative perceptions of students' achievement, otherwise, positive attitudes of teachers' epistemology would enact students to engage in multimodal composing and learning (Narey, 2017; Miller, 2010). Therefore, teachers' beliefs and self-efficacies would be related to their classroom teaching practices and students' learning effectiveness.

Method

The current study sought to explore how elementary school teachers integrate multimodal literacies in remote and hybrid instruction to support the educational outcomes of students during the COVID-19 pandemic. Maxwell (2012) proposed an interactive model of research design where the research question is the center of the model thus the methods researchers use should be able to answer the proposed research question. For the present study, we were interested in learning about the teachers' perspectives on multimodal instructional practices, a qualitative interview is an ideal method to explore our guiding research question. Additionally, qualitative interviews enable researchers "to gain in-depth knowledge from participants about particular

phenomena, experiences, or sets of experiences,” and open-ended interview questions can provide enough descriptions to construct a complete picture for the phenomenon of study (deMarrais, 2004; Roulston, 2010). Also, contextual factors can affect people’s decisions under certain circumstances in qualitative studies (Dixon & Theberge, 2011). As such, we wanted to explore how the elementary school teachers in this condition integrated multimodal literacies in remote and hybrid instructional settings. The data presented for the current study were approved by our university’s Institutional Review Board and consent was obtained from the participating teachers.

Participants

We used a purposive sampling approach to recruit participants selected based on their experiences related to the present research topic (Etikan et al., 2016). Participants were recruited through two graduate-level courses at a large southeastern university in the spring 2021. The students registered in these two courses are current P-6 teachers who presently are working on a master’s degree in early childhood and elementary education. In total, 55 teachers were contacted. A recruitment email was sent directly to all the registered teachers in the two courses. We chose to recruit potential participants through the two graduate-level courses because we considered that (a) the teachers in the master’s degree program are more likely to have background knowledge of multimodal literacies pedagogy, and (b) the teachers are from different schools and areas so we can reach out to potential participants from more varied teaching settings. Eventually, two teachers volunteered to take part in the current study. Both teachers conducted the Zoom interviews with Author A. For confidentiality purposes, we use two pseudonymous names, Mary and Allison, to represent the two participants in this study.

Mary, a white female, has eight years of teaching experience in elementary school and is currently teaching third-grade mathematics. There are four classrooms in third grade with 15-18 students in each classroom at her working school and teachers alternatively teach in-class and online sessions during 2020-2021 semesters. She has five students who are identified as English learners.

Allison, a White female, is in her first year of full-time teaching and is currently a first-grade classroom teacher. She has 14 students in her class. She has two students who are identified as English learners. She and coworkers also conducted alternative teaching sessions between in-class and online during 2020-2021 semesters.

Setting and Context

The current study was conducted in a southeastern university and the data collection was through Zoom. The teachers recruited for the current study are working at elementary school located in rural areas in one southeastern state. The students in these two schools are from linguistically and culturally diverse backgrounds as well as different socioeconomic status families and communities. The two participants have been teaching full-time in their sites utilizing remote and

hybrid modes during the entirety of the pandemic. Specifically, in the Spring 2020 semester, their schools shifted to a full-time remote instructional mode for the entire school day. During the Fall 2020 semester, both schools adapted to a hybrid model, where students alternatively participated in learning face-to-face in classrooms and from home via the internet. The teachers in their schools also worked alternatively in classrooms and online each week.

Data Collection

The interview data was the primary data source for this study. We conducted a semi-structured one-on-one interview with the two teachers separately over Zoom in February 2021. We aimed to collect the participants' perspectives and self-efficacy of multimodal literacies to gain an understanding of their practices in supporting students' educational outcomes. Interviews enable researchers to use questions to interact with participants to examine details in responses as well as to generate more additional responses or ask for clarification (Roulston, 2010). We chose to use open-ended questions in our interviews to generate in-depth perspectives within participants and enable them to formulate answers in their own way regarding the interview questions (Roulston, 2010). During the interview process, Author A took anecdotal notes to document any additional nonverbal responses that included facial expressions, overall affect, and/or hesitations in their responses. We included 17 interview questions in the interview protocol, which was guided by the phenomenological questioning technique to provide the researcher with detailed descriptions of experiences from the participants (deMarrais, 2004).

Data Analysis

We analyzed the interview data using a thematic analysis approach, which outlined six steps to define the themes throughout the dataset (Braun & Clarke, 2006). After the interviews were transcribed, the transcriptions were then coded using the NVivo software. We followed the Braun and Clarke's (2006) six steps of the thematic analysis approach to segregate the transcriptions into several categories.

First, we read through all the transcriptions and note down potential codes. Based on the interview questions, we finalized 19 codes for full transcription coding. The codes and examples are shown in Table 1.

Table 1

Codes and Examples

Code	Example	Code	Example
Multimodal tools used before COVID-19	"Decodable books, websites, flashcards, pictures, words."	Support from school or district	"We try to give every student a device."

Self-efficacy of using the multimodal tools before COVID-19	“I like what I used before. We tried to work on online resources too.”	Reasons of shifts on multimodal tools	“Our district all use google classroom now.”
Students’ reaction toward the multimodal tools	“Students like activities, not just reading textbook.”	Preparation for remote teaching with multimodal tools	“In remote settings, it’s more difficult than I thought. I just watch what other people do because I’m first year full-time teaching, so it’s new to me.”
Any different reactions of ELLs	“Digital texts help them a little bit more.”	Goals of teaching in remote settings	“Trying to teach them at the same level.”
Instruction type during COVID-19	“We did hybrid. Now is face to face.”	Strategies of multimodal literacies instruction	“We have slides to share information, pictures and digital books, media tools.”
Shifts of multimodal tools during COVID-19	“We all use google classroom now. Google apps such as slides, forms, docs.”	Self-efficacy of multimodal literacies instruction during COVID-19	“The resources are good, but students are not getting it. There is a gap between teaching and learning.”
Type of assignments during COVID-19	“XtraMath, Exact Path, and other digital programs.”	Skills for teachers of multimodal literacies instruction during COVID-19	“Arrange teaching contents with the tools effectively.”
Impact of current instructional practices for future classroom instruction	“I’ll keep what I used for now. It’s easy to grade for me, and homework is easy to go home.”	Skills for students to learn with multimodal literacies during COVID-19	“Navigating the digital platforms and still using pencil and paper to write.”
The impact of multimodal literacies instruction to students	“I feel that my ELLs generally fall behind other students.”	Challenges for teachers of multimodal literacies instruction during COVID-19	“Some problems like internet doesn’t work, or students have distractions in their backgrounds.”

Challenges for students to learn with multimodal literacies during COVID-19	“Be responsible to attend class and complete homework on their own.”		
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After coding the data, we found patterns for potential themes: (1) the types of multimodal tools used by the teachers in the remote or hybrid settings during the pandemic; (2) the advantages and challenges of these multimodalities for supporting students, including ELs; (3) the teachers' self-efficacy on the instructional practices of multimodal literacy; and (4) the teachers' beliefs about continuing these multimodal practices for future face-to-face instruction. Based on the codes, three themes emerged from the transcription relating to our research question. The data analysis process is shown in Table 2.

Table 2

Data Analysis Process

Phase	Process
1. Prepare data	Transcribing data, reading the data, noting down ideas.
2. Generate codes	Generating initial codes based on the ideas.
3. Generate potential themes	Coding data. Collating the codes into potential themes.
4. Review the themes	Checking if the themes fit the research purposes.
5. Define the themes	Generating clear definitions for each theme.
6. Produce the report	Write-up the findings.

Findings

The data analysis indicates three overarching themes about the two teachers' perspectives of interdisciplinary multimodal literacies instruction in remote and hybrid settings during the COVID-19 pandemic.

Utilization of Multimodal Literacies in Instruction

During the COVID-19 pandemic, remote and hybrid learning relies heavily on internet-based digital tools with supportive print-based visual texts. In the interviews, both Mary and Allison expressed the benefits of utilizing digital tools in their remote instruction. Overall, the digital tools provided a convenience factor for both teachers regarding the preparation of instructional materials and content, management of class assignments, and increased engagement of

instructional activities in the remote setting. For example, Mary said she used Jamboard and Google Slides to arrange content because “it’s easier to plan and organize digital content and assignments.” Allison also preferred to use digital tools because “students like doing activities and games via digital tools, not just reading textbooks,” and with digital tools, “students engage and interact more through the websites because it’s like games for them.” It appears both teachers perceived the use of digital tools as providing them with easier instructional planning, better management of students’ assignments and opportunities to create engaging learning tasks suggesting an increased self-efficacy in use of digital tools.

The fact that both teachers increased their use of internet-based digital tools during the COVID-19 pandemic is understandable as no other options existed during the Spring 2020 semester. Regarding the role of digital tools and resources in teachers’ planning, Mary mostly used Google products with her third graders for Math. She described, “We all use Google classroom in our school during the pandemic, and we also use other Google apps such as Google Slides, Google Forms, Google Docs.” Mary’s preference to rely upon digital resources in Math could be a result of her comfort level with such applications. Additionally, Mary believed that these online math programs help support in providing instructional practice opportunities for her students while simultaneously engaging her students given their game focused nature. She explained:

We use Google Slides to practice math questions for 15 minutes every day in the morning. We also use online math programs, such as XtraMath, Exact Path to practice math questions. These are more like game-based learning tools, so kids love them.

On the other hand, Allison indicated the use of several types of digital tools combined with print-based texts during remote instruction. Allison shared that as a first-grade teacher, she is responsible for teaching all the content areas thus, she drew from a variety of instructional resources--both accessible online and those available in face-to-face contexts. She described how she utilized and integrated different instructional resources when teaching in remote and hybrid settings. Allison explained:

I use a lot of different resources in remote and hybrid teaching such as decodable books and websites, flashcards, pictures, print words and papers for students to read. I also use media tools and digital resources like Google slides, Schoology, Seesaw, and some websites.

It appears that Allison perceived the use of a range of instructional resources as integral to supporting her students specifically in literacy related instruction. Perhaps, this is because first grade teachers spend much time on early literacy instruction which requires access to materials that may not be as accessible via an online context. For example, when asking about what specific types of multimodal instructional resources and tools specifically in different content areas, Allison explained:

I have been using Google slides, Schoology, Seesaw, and websites like *Teach Your Monster to Read* to teach English literacy and help students to practice reading and writing. And I have been using Pearson online and Google slides to teach math. I did not start to teach science until we do face-to-face mode, because the science experiments need to be done in the classroom.

Despite the convenience and efficiency of digital tools, both teachers expressed the importance of using print-based texts in their teaching and some concerns upon other skills such as handwriting might suffer given the use of technology. For example, Mary explained: “We still need pencil and paper for tests. Students still need to know how to write with pencil and paper and be prepared for the future when school shifts back to face-to-face instruction.” Allison expressed similar sentiments regarding handwriting practices as she believed handwriting skills are still necessary for first grade students because “students still need to know how to write their name with pencil and paper, and they write their journal everyday with pencil and paper.” It appears that both Mary and Allison believe that with the increased use of technology, students might lose out on opportunities to practice skills such as handwriting when in remote teaching and learning contexts. However, there are certainly ways to support children’s handwriting skills through multimodal tools even in remote settings. This “either or” thinking seems to be prevalent in the ways these teachers conceptualized their teaching practices during the COVID-19 pandemic.

In summary, based on the two teachers’ narratives, both digital tools and print-based texts are used in instruction especially for digital literacy skills. Although the teachers relied more on Internet-based digital literacies, they still expressed the need for print-based texts, especially to help students practice their handwriting skills. It appears that they view the use of print-based texts as one resource that aids in supporting their students’ handwriting skills but unsure about how to support these skills in remote settings.

Concerns about Online Multimodal Literacies Instruction

Multimodal tools, when used effectively, can facilitate instruction and comprehension of content, but teachers and students still face challenges especially related to technological issues. A persistent concern expressed by Mary and Allison related to barriers associated with the access and use of technology thus resulting in ineffective multiliteracies instruction. Specifically, both teachers chose to utilize digital tools in their multimodal instruction which relies heavily upon stable internet connections, available devices, and proper functioning of those devices. Additionally, this frustration is compounded given the age and skill of their students. Finally, the technological issues are most often out of the locus of control for the teacher and often the learner which only adds to the frustration felt both by teacher and learner. For example, Mary explained, “There are problems like the internet doesn’t work, or students have distractions in the background so they can’t really concentrate.” Allison also expressed similar concerns regarding technical issues indicating that, “My students are young, so they need help all the time. Sometimes devices are not working and we don’t have devices for every student now.” Also,

technology relies on the proper usage and both teachers expressed an added pressure of helping students practice with the functions of digital tools in remote instruction. Accordingly, Allison noted that “my students are six or seven years old. They don’t know what they are going to do at home, and they need adults to be there with them to help them work with computers or devices.” Even with older students, Mary also perceived a similar issue asserting that, “You need to teach students to use the Chromebook appropriately, like Google apps, copy and paste.” Both Allison and Mary expressed concerns about having to teach students how to use the different digital tools in order to learn content in a remote or hybrid context. Again, they both acknowledge an added layer of pressure related to teaching the technological skills while also feeling the added burden to teach the academic content, knowledge and skills separate from the technology.

Instruction with EL Students

In terms of multimodal instruction with EL students, teachers expressed even more concerns about the context of remote learning. Both teachers believed their EL students benefited from the use of digital tools in classroom instruction before the pandemic. Mary indicated that she has seven ELs in her third-grade class, and she believed “digital texts help them a little bit more” in face-to-face settings. She thought digital tools were able to present information more clearly than print-based texts only, so ELs tended to show their understanding in math better using digital tools. Allison’s views are similar to Mary’s in that her EL students benefited more when learning utilized digital tools. She had two ELs in her class, and she found them to be more engaged in learning when utilizing digital tools with class activities and homework.

However, both teachers indicated several barriers for their EL students learning in remote settings during the COVID-19 pandemic. The most obvious barrier is the EL students’ limited English proficiency could not support their use of technology to learn the content at home. Allison thought her EL students generally had less gains in achievement as compared to pre-pandemic, so they have more disadvantages than English-speaking students in remote learning: “The EL students were not being involved as other students, so they are actually getting less instructions than before.” Mary worried her EL students will show “bigger gaps” than English-speaking students when shifting back to normal face-to-face instruction because they need additional linguistic and instructional support in remote instruction, so she thinks “the EL students are disconnected, and they fall even further behind than English-speaking students.” Based on these narratives, Mary and Allison showed a lack of knowledge and strategies to support linguistically diverse students to acquire language and to learn information with digital tools in remote settings. Although multimodal instruction can be beneficial to students as we discussed above, younger aged EL students may not benefit from such instruction until they can get sufficient support from their teachers as they normally do in face-to-face instruction.

Multimodal Literacies in Future Classroom Instruction

Most K-12 schools in the US resumed teaching face-to-face in the fall of 2021. The instructional practices at least those reported by Mary and Allison potentially may be influential for future

classroom teaching and learning. Given both teachers indicated the prevalent use of digital tools specifically during remote instruction, teachers may make similar choices on the types of multimodal instructional practices and tools they continue to use when shifting back to face-to-face instruction. The teachers valued the convenience of the digital tools for planning the teaching content, organizing instruction, keeping practices, and class management. Mary expressed her willingness to keep using the multimodal instructional practices, specifically digital tools she used in the remote and hybrid settings, when shifting back to face-to-face instruction. She explained:

I really enjoy the digital tools, so I'll keep what I've used for now, and students have more privileges of using Chromebooks. Using digital tools is easy to grade for me, and the homework is easy to go home. Everything is getting easier with digital tools. But I should also have plan B in case digital doesn't work.

Allison also indicated she will continue to use most of the multimodal instructional practices and digital tools when school shifts back to face-to-face instruction, "some multimodal tools (e.g., digital tools) are the same as we used before the pandemic, like Seesaw and Decodable books, so mostly are the same. But I probably won't use Schoology because it's more suitable for virtual or online teaching." From Mary and Allison's perspectives, it appears that they both view their experiences utilizing multimodal literacies during the pandemic as potential practices to use in the future. Specifically, digital tools are convenient for teachers to manage, reuse teaching content, and to organize assignments such that they may want to keep using their preferred multimodal practices in future contexts.

In summary, the findings highlight the benefits of utilizing digital tools, one aspect of multimodal literacies instruction specifically related to providing convenience for the teachers. However, despite these perceived benefits associated with convenience, there are still challenges faced by both the teachers and students. Although teachers' have positive efficacy about the multimodal literacies they used for management of assignments, and pedagogical practices related to the utility of digital tools to provide practice opportunities, considerations still persist about how to utilize multimodal literacies to benefit students in learning content and how to best support students to eliminate gaps in future classroom instruction.

Discussion

From our findings, multimodal tools are convenient for teachers to organize instruction and engage students in the activities and assignments in remote settings during the COVID-19 pandemic. However, challenges and issues emerged during this time and are worth deeper exploration by teacher educators and educational researchers alike (Lynch, 2020). The teachers' self-efficacy and perspectives on current multimodal instruction would potentially impact their instructional practices in future face-to-face mode.

Given the COVID-19 context, the teachers recognized the flexibility and affordability of the digital tools for content creation, delivery, and assessment purposes. In this way, the digital tools helped the teachers to be more efficient in their preparation of teaching materials which potentially can afford them more time to devote to pedagogical practices that potentially support students learning. Research indicates that teachers' self-efficacy of technology integration is strongly associated with TPACK, which impacts their pedagogical practices (Bakar et al., 2020). Additionally, teachers' knowledge regarding TPACK domains is predictive of their self-efficacy about technology integration in pedagogy (Abbitt, 2011). Therefore, for these teachers, more knowledge about technology integration specifically in multimodal literacies instruction would be helpful for the teachers to be more effective in teaching in remote contexts. Additionally, the teachers believed their students were more engaged in the activities and practices they used on digital platforms. However, the teachers' still expressed concerns about a lack of preparation, either from themselves or their school districts, of technology-based remote instructional knowledge and strategies, which can help them to be more adept and creative in lessons and pedagogy with multimodal tools to improve students' educational outcomes (Martin et al., 2010; Youngs & Kyser, 2021). From TPACK perspectives, more training or supportive resources of technological instruction and digital literacies would be helpful for the teachers to conduct pedagogical practices in the remote or hybrid teaching settings.

During the COVID-19 pandemic, students' achievement may present disparities or large gaps in certain groups of students (Korkmaz & Toraman, 2020; Lynch, 2020). Both teachers expressed concerns about potential gaps among their students in remote or hybrid learning settings due to limitations of digital tools such as proper functioning and using guidance. Also, both teachers tended to believe their EL students are in more disadvantaged situations than English-speaking students during remote learning. The teachers mentioned their EL students have benefited from the digital tools that used in classroom before the pandemic, especially on mathematics. However, during the remote learning, the teachers believed their EL students were not benefited from the digital tools as much as in classroom because of the insufficient linguistic resources that the teachers provided to help students understand the instruction. Without appropriate guidance, EL students may show more difficulties in following instructions as well as being able to actively participate in activities and assignments in remote learning settings (Sugarman & Lazarin, 2020). The visualization features of digital tools can present information in a clearer manner and enable non-linguistic modes rather than merely texts, so the EL students can comprehend the information and demonstrate their understanding of the numbers in math (Boaler et al., 2016; Yuan et al., 2019). This suggests that teachers need to explore more meaning-making modes on digital tools to potentially afford more linguistic support for students, especially for EL students.

In general K-12 education, multimodal literacies are commonly utilized by teachers and families in various learning settings to support children developing various abilities and cultural identities (Si et al., 2022). Despite both teachers recognizing the convenience of the digital tools in remote instruction and having positive self-efficacy with digital tools, they tended to demonstrate binary perspectives on how to support linguistically (e.g., reading and writing) based literacy skills in a

remote context. For example, their limited views of how to conceptualize handwriting instruction potentially prevented them from thinking about how to support those linguistically they expressed beliefs in the need for face-to-face instruction to teach handwriting skills utilizing pencil and paper methods. However, children's writing skills may be independent from the modality, some researchers found no significant difference on first grade students' performance with digital and pencil-paper writing (Spilling et al., 2022). The teachers in current study appear to have difficulties in conceptualizing how to use practices in an online context that support more traditional literacy skill sets (e.g., handwriting, letter formation).

Implications for Future Research

The current study employed a qualitative study methodology to analyze the teachers' perspectives and self-efficacies regarding multimodal literacies instruction in remote and hybrid settings during the COVID-19 pandemic. However, there are several areas for future research that can support this line of inquiry. First, multiple data sources should be used to fully describe and highlight the cases in more substantial and nuanced ways. For example, more data sources such as classroom observations (e.g., remote and face to face contexts), field notes, and students' work samples would be helpful to understanding the role multimodal literacies play in classroom teaching and learning. Additionally, in-service teachers' multimodal literacy practices may relate to the professional development opportunities. Future research should examine how teacher education programs and professional development opportunities educate both preservice and in-service teachers in TPACK.

Conclusion

Multimodal literacies utilized in various in-person and remote teaching and learning settings have the advantages of facilitating teachers and students to contact different types of information to obtain comprehension and skills across disciplines (DeCarlo et al., 2018; Downs et al., 2011). The current study contributes to the synthesis and analysis of the perspectives from two teachers on interdisciplinary instruction with multimodal literacies during the COVID-19 pandemic. Although conducted in a regional context, this study has implications for elementary schools and teachers nationwide, where instruction needs to shift between remote and face-to-face mode in post-pandemic conditions. Since the COVID-19 pandemic is a novel situation worldwide, there are limited previous experiences and matured practices that educators can refer to the current situation. Therefore, the current study is shedding light on the advantages and challenges of multimodal literacies instruction for both teachers and students, and provide implications for teachers to integrate multimodal literacies into classroom instruction.

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INCREASING PRESERVICE TEACHER SELF-EFFICACY FOR STRATEGIC THINK-ALoudS IN LITERACY INSTRUCTION

**DR. TRACEY S. HODGES
DR. SHARON M. PRATT**

Abstract

Much research has been conducted on preservice teacher self-efficacy, yet little is still understood about the connection between self-efficacy beliefs and actual practice and implementation. In the past few decades, researchers have examined the nuances of self-efficacy beliefs as they relate to specific content areas, contexts, and skills. One area that has been under-explored is in how preservice teachers learn to plan and intentionally reflect on their use of think-alouds and how this knowledge may increase their self-efficacy for writing instruction. The present study seeks to close these gaps within previous research by measuring self-efficacy for writing instruction after practice and application of write-alouds. Our findings show increased preservice teacher self-efficacy beliefs after instruction on think-alouds, potentially increasing their ability to effectively implement this strategy. We provide implications for teachers related to aligning their self-efficacy beliefs and writing instruction practices.

Keywords: think-alouds, preservice teachers, cognitive apprenticeship, self-efficacy, writing

Increasing Preservice Teacher Self-efficacy for Strategic Think-Alouds in Literacy Instruction

Practicing teachers have many strategies in their teaching toolbox to instruct learners. One of the greatest tools is the think-aloud, which can help demystify the thinking processes involved in reading and writing while allowing learners to develop metacognitive skills. At the same time, think-alouds can help teachers increase their self-efficacy for teaching writing by giving them additional opportunities to reflect on the writing process. Combining the study of teacher self-efficacy for writing and think-alouds, therefore, may provide deeper connections to literacy instruction for practicing teachers.

Before teachers use think-alouds in their own classrooms, they need to develop the skills to use them effectively. Within teacher education, preservice teachers (PSTs) can develop their self-efficacy for teaching and skills in using think-alouds by reflecting upon different pedagogical techniques, strategies, and lessons (Tschannen-Moran & Johnson, 2011). Teachers who develop self-efficacy specific to writing are more likely to engage their students in a variety of writing instructional practices and focus more time on writing in the classroom (Hodges et al., 2021;

Zimmerman et al., 2014); therefore, developing self-efficacy beliefs should be a critical component of PST education.

In addition to considering self-efficacy beliefs generally about writing instruction, little research has been conducted about the impact of learning and practicing think-alouds in writing instruction on PSTs' self-efficacy for writing instruction. Think-alouds have been established as a best practice for engaging students in the metacognitive practices that accompany strategy and skill development. Prior research indicates that PSTs demonstrate greater confidence in modeling reading strategies than teaching writing (Bostock & Boon, 2012; Helfrich & Clark, 2016).

In this study, we focus specifically on how development of think-aloud pedagogies impacts self-efficacy for PSTs' own writing and writing instruction. We focus on PSTs as a starting point to consider how inservice teachers can further develop their self-efficacy for writing and using think-alouds effectively. After presenting our findings related to preservice teachers, we provide suggestions for practicing teachers to continue honing their skills in teaching writing effectively through think-alouds.

Literature Review

Self-Efficacy and Think-Alouds

For teachers to be able to model literacy strategies, skills, and applications, they should possess high or moderate levels of self-efficacy for both writing as a craft and teaching writing (Hodges et al., 2021). Additionally, Hodges et al. (2021) found that highly competent teacher educators practice writing, and practice creating writing lessons increased PST self-efficacy for writing instruction. Bandura (1986) defines self-efficacy as the ability to complete a task with confidence and persevere even if the task is complex or difficult. In other words, self-efficacy is a person's belief that they have the skills, cognitive processes, and knowledge to complete a task and figure out solutions if they encounter problems. When applied specifically to writing, self-efficacy pertains to completing writing tasks, as well as using writing as a tool for learning or living (Pajares, 2003). Hodges et al. (2021) further describe PST self-efficacy as future teachers' perceptions of their ability to complete writing tasks, teach specific components of writing such as organization or prewriting, and teach writing holistically. When PSTs indicate high levels of self-efficacy for writing instruction, they are more likely to engage future students in writing tasks, provide opportunities to practice writing, and teach writing effectively (Hodges et al., 2021; Tschannen-Moran & Woolfolk Hoy, 2001). Therefore, self-efficacy, grounded in sociocognitive theory, informs much of the work of this study related to write-alouds.

Self-efficacy research with a focus on writing instruction is a growing field (Graham et al., 2022). In recent years, several studies have added to the field's understanding of how preservice teachers develop their beliefs about teaching writing. Yet, one limitation of this research is that many of the results are broad in scope, identifying general components of writing instruction, rather than specific strategies (Hodges et al., 2021b). For example, in reading instruction, much

research has found that increasing teacher knowledge of reading components correlates to more evidence-based instruction in reading (Binks-Cantrell et al., 2012). Similar work needs to be conducted for writing instruction.

Research on self-efficacy has consistently reported that reflection and deep learning on a topic can increase self-efficacy beliefs (Bandura, 1986; Graham et al., 2022). This is particularly true for preservice teachers who are developing their teaching skills alongside their self-efficacy beliefs (Zimmerman et al., 2014). When preservice teachers are taught new skills, provided time to practice those skills, and additional time to receive feedback from a teacher educator or mentor, with discussions, their self-efficacy beliefs increase. We used this model to focus on another area that is under-researched in how preservice teachers develop skills for teaching using think-alouds.

One pedagogical strategy that is often cited as improving student outcomes is the think-aloud. However, research has not been conducted that links increasing preservice teacher knowledge of think-alouds to their self-efficacy for teaching writing. The present study seeks to fill these gaps.

Think-Alouds Development for Writing Instruction

For K-12 students to become strategic, engaged writers, they need instruction about the metacognitive processes and decision-making required to complete writing tasks. Write-alouds provide a window into the strategic decision-making that is required of skilled writers (Colwell, 2018; Fisher et al., 2008; Jones, 2015; Linares, 2018). Writing is not just placing words on a page but involves making choices at nearly every stage of the writing process. When students are mentored in the thought processes that are behind these decision-making steps of the writing process, they become more sophisticated, proficient writers (Graham, 2020). Teachers also need to guide students to employ multiple strategies and skills in an integrated manner.

Within writing, research consistently shows that in-service teachers feel unprepared from their teacher education programs for writing instruction (Brindle et al., 2016; Cutler & Graham, 2008). Additionally, PSTs report low self-efficacy in their writing abilities and skills (Hodges et al., 2019; Aydin, 2018). PSTs also report inconsistent time and instruction on concrete writing skills such as grammar, organization, the writing process, and genres of writing (Hodges, 2015). Most teacher preparation programs do not have a specific course on writing, so the types of writing that preservice teachers are most likely to see modeled is in conjunction with reading skills (Myers et al., 2016). While teaching reading and writing together is beneficial to students, PSTs may not see the most effective ways to teach and model discrete writing skills. Explicit instruction and modeling of strategies within the writing process and the craft of writing may increase PSTs' confidence (Aydin, 2018; Hall, 2016; Kramarski & Kohen, 2017).

Because PSTs often lack a conscious and proficient use of writing strategies and skills, they experience difficulties modeling their thinking during writing instruction (Alston & Danielson, 2021; Coker et al., 2016). PSTs often present information and ask questions of their students,

rather than teach metacognitive use of strategies to guide one's writing process. Determining when to release responsibility to the student, with the appropriate amount of scaffolding and feedback, can also be more difficult for PSTs to implement in their teaching (Nuckles et al., 2020; Zimmerman et al., 2014). When utilizing write-alouds, PSTs find it easier to share the steps of the writing process or strategy they are implementing versus naming the strategy, when to use it, and why it is helpful to them as a writer (Pratt, 2020).

PSTs benefit from substantial scaffolding as they develop proficiency and confidence in writing instruction pedagogies (Zimmerman et al., 2014). When teacher educators provide explicit modeling in writing strategies and skills, PSTs can increase their personal writing skills and confidence in implementing explicit strategy instruction (Alston & Danielson, 2021; Pratt, 2020). Teacher educators should model think-aloud lessons for PSTs to demonstrate how to go beyond giving students directions or asking questions to verbally sharing one's thinking aloud while writing. Additionally, teacher educators should provide explicit instruction in scripting think-alouds with the four components of metacognitive knowledge described above (what, when, why, and how). Research also indicates positive impacts on their pedagogy development when PSTs practice their think-alouds with peers in the classroom and virtually, with opportunities for reflection (Hall 2016; Kramarski & Kohen, 2017; Pratt, 2020). Practicing write-alouds with peers moves strategies from the unconscious to the conscious mind which helps build PSTs' confidence in using writing strategies during instruction.

Gap in the Current Literature

Our review of the research on think-alouds with PSTs indicates a growing body of research with effective teacher education practices for supporting PSTs in practicing think-alouds for writing (Alston & Danielson, 2021; Aydin, 2018; Hall 2016; Pratt, 2020). However, the connection between self-efficacy for writing and writing instruction with practice in think-alouds has not been addressed. The present study seeks to close these gaps within previous research by connecting self-efficacy for writing instruction using think-alouds. Accordingly, our research question was: What is the impact of development of think-aloud pedagogies on PSTs' self-efficacy for writing and writing instruction?

Methods

For this pre- and post-survey, intervention design, we used quantitative methods to determine PSTs self-efficacy for writing instruction before and after instruction focused on building knowledge for and creating think-aloud lesson plans.

Participants

This study included 133 participants from two universities enrolled in elementary literacy methods courses. Data was collected from Spring 2020 through Spring 2022, 46 from a university in the Southeastern United States and 83 from a university in the Midwestern United

States. Four students did not report their institution. The students were female ($n = 121$) and male ($n = 4$), and self-identified as White or Caucasian ($n = 111$), Hispanic ($n = 12$), Black ($n = 1$), Arab ($n = 2$), and other ($n = 1$). Eight participants did not report their gender and six did not report their race. The respondents indicated they were seeking an elementary certification for grades PK-6, and one was seeking a master's degree. Additionally, all participants from the university in the Midwestern United States were receiving dual certification in special education and general education. One participant each also reported seeking additional certifications or degrees in food and nutrition and Spanish, while one student was pursuing a master's degree.

Study Procedures

While the study procedures outlined below are specific to providing instruction to PSTs, the same format and structure could be used for a variety of professional development opportunities for practicing teachers. Therefore, we provide the detailed plans. Current instructional coaches, teacher leaders, administrators, or other school leaders could adapt the practices to help their teachers better understand their self-efficacy and align those beliefs to their writing instruction practices.

Prior to introducing think-alouds in writing instruction, PSTs participated in an online discussion board in which they conducted a pre-writing task given a specified prompt. While conducting this task they were asked to audio recording them thinking aloud reading the prompt and compiling some pre-writing notes that could be used to create a story draft. They were then asked to discuss with each other the types of cognitive processes they verbally heard in each other's think-alouds. This initial discussion board encouraged students to become more self-aware of their thinking while writing.

Over two in-class sessions that totaled approximately three hours of instruction, the PSTs learned about designing and rehearsing think-alouds in writing instruction with the components of metacognitive knowledge (what, when, why, and how). The content for this instruction was derived from what research indicates makes effective think-alouds and how to best guide PSTs in developing their use of instructional practices (Almasi & Hart, 2011; Graham et al., 2019; Ness, 2015; Pratt, 2020; Shanahan et al., 2010; Troia et al., 2011). These instructional sessions were comprised of a class lecture with discussion, modeled think-alouds by the instructors, analysis of a video of a model think-aloud lesson, and partner practice scripting and role-playing a think-aloud. Throughout the class activities, instructors modeled the gradual release of responsibility process moving from teacher modeling to guided practice and then peer coaching. During the instructor modeled think-aloud, PSTs were asked to compare what they saw and heard to a written lesson plan to see how the gradual release of responsibility and explicit explanation of think-alouds were implemented. During partner practice, participants were provided a list describing several pre-writing strategies (e.g., brainstorming, clustering, and free-writing) and another creative writing prompt. The prompts used within our class sessions and online discussions came from *The Creativity Project: An Awesometastic Story Collection* (Sharp, 2018). Partners collaboratively selected a pre-writing strategy and scripted a think-aloud that could be

shared with elementary students to model pre-writing for a creative writing task. PSTs then took turns role-playing their script.

After the two focused class sessions on think-alouds, PSTs individually scripted and rehearsed a think-aloud for pre-writing with a similar creative writing prompt. They then shared their recordings and written notes on a discussion board for peer critique and suggestions for improvement. Table 1 provides the pre- and post-discussion board directions. Additional role-playing and practice were integrated in subsequent class sessions for PSTs to see how think-alouds could be used for a variety of writing instruction genres and steps of the writing process. The two authors were the instructors and used the same materials during the two focused in-class sessions and online discussions to parallel our instruction as much as possible.

Table 1

Online Discussion Directions

Pre-Discussion
<i>Initial Post</i>
For your initial post, you are going to create an audio recording of how you would conduct a pre-writing task of planning your important points and supporting details. Audio record yourself as you speak your thought processes aloud while creating written notes that could be used to later draft out a piece of writing.
For your initial post, include these two items:
<ol style="list-style-type: none">1. Your audio recording2. The written notes you created during your audio recording (either as a jpeg or text in your initial post)
Okay, here it is. This should be your first attempt at planning, not a polished rendition! Here is the writing prompt, but first turn the audio recorder on and then read through the prompt and begin talking about what you are thinking as you go. Tell how you think through creating a list of at least three ideas, with supporting details, while writing it down. Go!
Prompt: “Weird. How could I have not noticed that door before? This was crazy. I reached for the knob (Sharp, 2018, p. 87).”
<i>Peer Responses</i>
The peer responses in this discussion board are intended to provoke a back-and-forth conversation. I am looking for a minimum of two in-depth responses, with some follow-up to your peers. Thus, make sure you give your peers reasons to engage in a conversation with the responses you provide. Additionally, reply to people who respond to your initial post. To go above and beyond assignment requirements and earn full points on this discussion board, jump into others' conversations that you find intriguing, as well as possible questions I propose to

the class within someone's post. Consider the following aspects in your in-depth feedback to at least two peers:

- How well did they share their subconscious thought processes aloud for others to hear? (Consider both statements that were clear to you and statements that left you confused about what they were thinking.)
- Propose ideas that would make the think-aloud clearer or parts that you think were left out of their think-aloud.
- Discuss thinking processes they verbalized that help us better understand what writers do when they engage in the pre-writing stage of the writing process.

Post-Discussion

Initial Post:

For your initial post, you are going to create an audio recording of your thinking process. You will explain your thinking about what your mind would do for a pre-writing task, just as you would explain it to a group of elementary students. This should be an actual think-aloud you would give to students, not just an explanation of what you would say. Say it as if it was "live" in the classroom!

Remember as you think aloud that you are pretending to do this in front of a class of elementary students, with the goal of showing them the metacognitive task of how you do pre-writing - or planning your ideas to write about later in the drafting stage. During your think-aloud you will share your thinking aloud as you model to students your thought processes as you create some type of written notes that will be used later for drafting.

To prepare for your recorded think-aloud, think of a specific pre-writing strategy you would want to model for students that fits the prompt below. Although you are not limited to these pre-writing strategies, this website (<https://writing.ku.edu/prewriting-strategies>) is a helpful resource to consult in determining a possible pre-writing strategy.

Prompt: "You are walking along the beach, when you come upon a small box, no bigger than a shoe box, half-buried in the sand. It's covered in barnacles and seaweed, but the lock is broken. You open it up and..." (Sharp, 2018, p. 259).

For your initial post, include these two items:

1. Your audio recording
2. The written notes you created during your audio recording (either as a jpeg or text in your initial post)

Peer Responses

The peer responses in this discussion board are intended to be feedback focused, rather than conversation provoking. Therefore, I am looking for a minimum of two in-depth responses,

but not necessarily a back-and-forth conversation. To go above and beyond assignment requirements and earn full points on this discussion board, make sure your two responses are detailed and substantive. Consider the following aspects in your in-depth feedback to at least two peers:

- How well did they make their subconscious thought processes more concrete for elementary age students? (Consider both statements that would be easy for elementary age students to understand and those that would be confusing for this age level.)
- Propose ideas that would make the think-aloud clearer for elementary age students.
- Propose ways to better integrate the aspects of quality think-alouds (i.e., what, when, why, how).

Think about these questions in proposing ideas to your peers: (a) Did they name or label the strategy they were using? (b) Did they model when to use the strategy and why? and (c) Did they explicitly model how to use all the steps of the strategy?

Data Sources

We administered a survey pre- and post-semester to determine PSTs' self-efficacy for writing, called the Preservice Teacher Self-Efficacy for Writing Inventory (Hodges et al., 2021). Because self-efficacy for writing is widely studied and applied to PST education, we chose to examine how our PSTs' self-efficacy for writing and writing instruction changed over the semester. To determine the PSTs' self-efficacy for writing we administered the Preservice Teacher Self-Efficacy for Writing Inventory (PTSWI; Hodges et al., 2021). This instrument measures PSTs' self-efficacy for writing instruction, teaching writing elements, and writing. The PTSWI was given at the beginning of the semester prior to instruction and at the end of semester to determine how PSTs' self-efficacy may have changed after introduction and practice to think-aloud pedagogies in writing instruction.

Data Analysis

To analyze the PTSWI, we first created augmented scores for three factors: (1) self-efficacy for writing; (2) self-efficacy for teaching writing elements; and (3) self-efficacy for writing instruction. Using these three scores, we can better understand PSTs' self-efficacy for writing and writing instruction before and after the think-aloud instruction. We conducted paired-samples t-tests to determine how PSTs' self-efficacy for writing and writing instruction changed from beginning to end of semester.

Results

For the quantitative data, we examined how the PSTs' beliefs about writing changed over the semester and determined if these changes were statistically significant. Specifically, we focused

on their preparedness to teach writing, confidence teaching writing, confidence completing writing tasks, and self-efficacy for writing, teaching writing elements, and writing instruction.

Preservice Teacher Self-Efficacy for Writing Inventory (PTSWI) Results

Preparedness to teach writing. From our pre-survey data, the average preparedness to teach writing, was 2.37 while the post-survey data showed a decrease to 1.83. This change is statistically significant at the $p < .0001$ level (see Table 2).

Confidence to teach writing. Participants' confidence to teach writing was at a 2.50 on the pre-survey and a 2.05 on the post-survey. This change is not statistically significant.

Confidence completing writing tasks. Finally, we examined how the PSTs reported their confidence for completing writing tasks. The pre-survey showed a mean of 1.78 while the post-survey showed a mean of 1.80. This change is not statistically significant.

Factor 1: Self-efficacy for writing. The first ten Likert items on the PTSWI create a factor called *self-efficacy for writing*, measuring PSTs' perception of their own writing ability. Based on pre-survey data (see Table 2), our participants' mean for this factor was 3.60 and the post-survey reported a mean of 3.93, which was a statistically significant increase at the p is less than or equal to 0.001 level. This result indicates that the focus on think-alouds and courses increased PSTs' self-efficacy for their own ability to write.

Factor 2: Self-efficacy for teaching writing elements. The next 15 items on the PTSWI represent preservice focus on teachers' *self-efficacy for teaching writing elements*, a factor that analyzes specific skills related to writing such as the writing process, organization, grammar, and student motivation, among others. At the beginning of the semester, PSTs reported a mean of 4.00 and at the end of the semester reported a mean of 4.38. This result was statistically significant at the p is less than or equal to 0.01 level, indicating that future teachers made a substantial increase in their beliefs about teaching discrete elements of writing.

Factor 3: Self-efficacy for writing instruction. The final 13 items on the PTSWI represent PSTs' *self-efficacy for writing instruction*, which examines their perceptions of teaching writing holistically, such as using standards and aligning activities to grade level expectations. At the pre-survey PSTs' mean was 4.35 and at the post-survey, their mean was 4.49, which was not statistically significant. These means were among the highest overall, indicating that PSTs felt confident in their overall abilities to teach writing effectively.

Table 2.

T-test results for the three self-efficacy factors

Item	Pre-Survey		Post-Survey		t	p
	M	SD	M	SD		
Prepared	2.37	0.66	1.83	0.67	4.61	.001**
Confident	2.50	0.75	2.05	0.64	3.64	.001**
Writing Tasks	1.78	0.57	1.80	0.68	.21	.838
F1	3.60	0.59	3.93	0.48	4.47	.001**
F2	4.00	0.71	4.38	0.50	3.23	.003*
F3	4.35	0.43	4.49	0.31	1.95	.059

Note: *** $p < 0.001$, ** $p < 0.01$, * $p < .05$

Discussion

Two themes emerged from our data related to self-efficacy and think-alouds: (1) preparedness and confidence for teaching writing decreased, likely due to the PSTs learned more about the challenges of using think-alouds for writing instruction; and (2) self-efficacy for both writing and teaching writing elements increased. We also consider what these results mean for current practicing teachers and school leaders.

Decreased Preparedness and Confidence, Learning About the Challenges

One interesting finding in our results came from the items “how prepared do you feel to teach writing?” and “how confident do you feel to teach writing?” With both of these items, we found statistically significant decreases between the pre- and post-assessments. While at first, this may seem negative, prior research indicates that PSTs have high levels of self-efficacy and may exhibit overconfidence in their teaching abilities (Hodges, 2015; Tuncer, 2020). This is likely because PSTs spent years as students, watching teachers and feel they can extrapolate those skills. However, as our data shows, as the PSTs learned more about think-alouds, their preparedness and confidence became closer to their true efficacy.

Examining the work of Hodges (2015) and Zimmerman et al., (2014), our conclusion that PSTs’ self-efficacy is approaching a more authentic reality is supported. Hodges (2015) found that PSTs’ self-efficacy decreased from beginning to end of semester and participants reported better understanding the demands of teaching writing. Research has also examined fluctuations in teacher interns’ self-efficacy across student teaching and found that their self-efficacy initially dropped quite significantly. PSTs reported that this heightened experience teaching revealed how much they still wanted to learn and how difficult teaching writing could be. Finally, Zimmerman et al. (2014) interviewed PSTs and found that they expressed wanting additional experiences to practice and teach writing, as they better understood how multifaceted it was. Together, these

studies support our conclusion that PSTs' self-efficacy decreased after gaining more knowledge about how to teach writing through think-alouds.

For current teachers, it is important to consider how self-efficacy beliefs shift. Research indicates that once teachers leave their preparation programs, they may see that their self-efficacy drops as they hone their teaching skills early in their careers. After professional development, particularly rigorous professional development, teachers may see the same drop in self-efficacy. These shifts in self-efficacy are natural and may indicate that teachers are redesigning or rethinking their instruction, which ultimately, are positive outcomes.

Learning about Think-Alouds Increased Self-efficacy for Writing and Teaching Writing Elements

We found PSTs' self-efficacy for writing (F1) and teaching writing elements (F2) increased statistically significantly from beginning to end of the semester. These results indicate that learning about think-alouds in the context of reading and writing likely increased PSTs' self-efficacy for applying their knowledge. One of Bandura's (1986) sources of self-efficacy comes from expert modeling or teaching, or the idea that self-efficacy beliefs increase when one watches someone who is an expert complete a task. This idea is also tied to cognitive apprenticeship (Collins et al., 1990; Rogoff, 1990) in which watching an expert think-aloud will help PSTs learn the cognitive processes and mental models for think-alouds. Connecting these conceptual and theoretical frames to our findings may support the increase we saw in self-efficacy beliefs around teaching writing.

While the PSTs did report feeling less prepared and less confident overall, when they were asked about applying their self-efficacy for teaching specific elements of writing (e.g., the writing process, teaching organization, teaching grammar) as well as their self-efficacy for writing, they reported stronger associations. This finding indicates that think-alouds and learning about how to design and apply think-alouds was useful in influencing their self-efficacy for teaching writing.

Research has long indicated that think-alouds are a useful tool for literacy instruction (Jones, 2015; Linares, 2018); yet research also shows that teachers may not be capitalizing on this practice (Coker et al., 2016; Graham, 2020). When PSTs learned about think-alouds, their self-efficacy for writing instruction increased. We hypothesize that this increase came from a deeper understanding of how to teach writing effectively and the opportunity to practice their own writing through thinking aloud their cognitive processes and action steps. With current teachers, who have skills for think-alouds, fine-tuning those skills may also lead to increase efficacy for teaching writing.

Implications for Practice

The findings related to think-alouds and self-efficacy in this study indicate the importance of providing time for PSTs to develop their own writing skills, so they feel confident in sharing aloud their thinking while modeling writing in front of their students. In the present study, we provided structured instruction over one semester as well as time to design and rehearse think-alouds. From our data, we found that this had a positive and statistically significant increase on PSTs self-efficacy. Other teacher education programs could modify and apply a similar structure of learning to enhance their future teachers' self-efficacy as well. In the greater scope of self-efficacy research, this study also provides support for tailoring instruction to specific competences such as think-alouds.

More importantly, we wanted to consider what these findings mean for current teachers and schools. Writing is an exceedingly complex skill to teach due to its multi-faceted nature. Writing requires a combination of cognitive, physical, social, and affective skills to accomplish. At the same time, few schools adopt writing curricula. Thus, teachers are tasked with developing their own curricula for teaching writing and trying to manage the many complex skills simultaneously. Finally, writing requires extensive time both to practice and assess. Many teachers have difficulty finding the time to provide adequate feedback and are stressed for time in the school day to provide concentrated time for writing tasks.

The findings of this study indicate that think-alouds may be a solution to some of these complex issues. Practically speaking, using our structure for teaching about think-alouds may provide an outline for professional development for teachers. This outline provides time to (1) deeply learn about the topic, (2) practice designing think-alouds, and (3) time to reflect on how those think-alouds worked with students or specific writing tasks. In learning about think-alouds, it would be beneficial for teachers to first do a writing task while attempting to articulate their thought processes aloud during each step of the completing the task. They could record themselves doing this task and share it with colleagues to brainstorm a list of possible thought processes they use when writing, as well as words that can be used to express these thought processes. Just as in our work with pre-service teachers, currently practicing teachers can build their knowledge of think-aloud pedagogy in writing instruction through watching and discussing a model lesson. Preferably, it would be best if they could either participate as a learner of a modeled think-aloud writing lesson or observe an instructional coach conduct one in their classrooms. If these are not options, online video recordings of model lessons could be selected instead (e.g., *Envisioning to Write with Detail Mini-lesson* by Teachers' College Reading and Writing Project: <https://vimeo.com/141188488>). After observing a model lesson/s, teachers can discuss and analyze the lesson with guiding questions, such as "How did the teacher make his/her thinking concrete or conscious for students?; What steps of gradual release were used in this write-aloud lesson?; How did the teacher guide students to share their thinking throughout the lesson?"

Next, we recommend teachers collaboratively practice designing think-aloud lessons by first choosing a goal, task, or writing strategy or skill they want to teach their students. They can then

plan how they would model conducting this writing task for students by writing a lesson plan in two columns, with action steps in one column and accompanying thought processes in the second column. While scripting the thought processes, teachers will want to make sure they include elements of explicit explanation of metacognitive knowledge (what strategy, when to use it, why it is helpful, and how to use the strategy). This initial script should be detailed to conduct the teacher modeling stage of gradual release of responsibility process. Further stages of the gradual release of responsibility should be added to the plan (guided practice, peer coaching, and independent practice) to scaffold students in taking on the writing skills or strategies for their own. A helpful tool for planning one's is The Think-Aloud Observation Protocol (Pratt & Hodges, 2023). This protocol can be used as a checklist to ensure a quality think-aloud lesson with all steps of gradual release of responsibility and an aligned focus that is clearly communicated to students.

Once lessons are collaboratively planned, we recommend teachers rehearse their think-alouds with peer feedback before delivering the lessons to their students. Teachers could take turns teaching the lesson for each other, reflecting, and making improvements after each lesson practice. As a virtual alternative to in-person rehearsals, similar to how pre-service teachers in our study practiced and reflected virtually, teachers could record their individual rehearsals of the teacher modeling portion of the lesson. They could then share these recordings with each other to provide both encouragement and constructive feedback for making their thinking more explicit and concrete for students. This practice can build teachers confidence for writing and sharing their thinking with their students. After implementing the writing think-aloud lessons with their students, teachers can then meet to reflect on how the lessons impacted student learning and how to refine their use of think-alouds to continue to support their students' writing development. We also recommend teachers do peer observations of each other in the classroom using The Think-Aloud Observation Protocol (Pratt and Hodges, 2023) and use the protocol to reflect upon strong aspects in their think-alouds and areas for continued refinement in their practice. We suggest these steps described above as one method for developing current teachers' think-alouds and increasing their self-efficacy for writing.

Secondly, the measures we used to assess PST self-efficacy for writing can be used with inservice teachers as well. School leaders may find this measure helpful in better understanding how their teachers think about writing instruction. This knowledge could provide guidance for designing professional development, investing in curricular programs, or providing additional professional learning community time to plan and develop writing lessons. For example, the self-efficacy measure (PTSWI; Hodges et al., 2021) can be given to in-service teachers before beginning professional development in writing instruction to see how they view themselves as writers and how confident they are in specific areas of writing instruction (e.g., writing process, assessment, etc.). School leaders can then compile the results to see what areas could be beneficial for teachers to learn more about and practice using in their own writing. These results could be shared with teachers so they can help select what they would like to first work on in their writing instructional practice. Professional learning community time can be given to teachers to jointly developing their own writing skills and strategies using think-aloud, which

could result in improved confidence in modeling these skills and strategies for students in their classrooms. The self-efficacy measure could be given again after a sustained period of professional learning and practice implementing these writing skills and strategies within their writing instruction to see whether teachers' self-efficacy for writing and writing instruction changed as a result.

Limitations

Several limitations exist in this study. We focused specifically on explicit instruction with a gradual release model to provide instruction about think-alouds, with levels of practice ranging from guided instruction to peer and individual practice. This model is only one framework for instruction, and others may reveal different results relating to the application of think-alouds. Second, the foci of the two courses at two separate universities differed, with one focusing more on writing methods and one focusing on integrated literacy methods. However, our findings did not indicate differences across the two universities. Finally, as in all self-efficacy research, the findings are based on self-report data. As we highlight in our findings, this may mean that some elements of self-efficacy are over- or under-emphasized by the participants.

Future Research

While this study answered the specific research question, we are left with several additional considerations for future research. One area of future research is that of including self-efficacy for reading and reading instruction for PSTs. At the time of the present study, we did not find a comparable instrument to the PTSWI that focused on both self-efficacy for reading and reading instruction for PSTs. Future research may attempt to develop this instrument and provide additional insights into teacher beliefs about both writing and reading, related to think-aloud instruction.

Finally, the present study examined one method of teaching think-alouds to future teachers and determining their self-efficacy for teaching writing. Our methods of instruction focused on explicit instruction with gradual release of responsibility that included time to design and rehearse think-alouds. Future research may take this study further by exploring both PSTS and inservice teachers using think-alouds in classrooms and recording their instruction through video or audio mediums. These data sources may provide additional insights into how future and currently practicing teachers apply their knowledge of think-alouds effectively.

Conclusion

Think-alouds have been used in classrooms for many years, though research indicates that some teachers still do not use them as effectively as could be. In this study, we sought to determine if one method for instructing PSTs on the design and use of effective think-alouds would increase their self-efficacy for writing instruction. We found that our instructional approach did yield statistically significant increases to self-efficacy beliefs, while also providing a clearer depiction

of the intricacies of teaching writing effectively. This study is one step that fills a gap in better understanding how to use think-alouds, as well as how to better support teachers incorporating them in instruction.

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**PREPARING THE NEXT GENERATION OF MATHEMATICS AND
SCIENCE TEACHERS:
CONNECTING DISCIPLINARY CONTENT TO LITERACY
THROUGH EXPERIENTIAL LEARNING**

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Abstract

To strengthen teacher preparation and benefit future adolescent learners, secondary preservice teachers (PSTs) must understand and apply content-area literacy (CAL) strategies and disciplinary literacy (DL) practices to their instruction. In this study, PSTs' lesson plans and reflections, both contextualized through field trip experiences (i.e., art museum and recycling center), were used to examine their knowledge of CAL and DL. Lesson plans were coded, and reflections were analyzed through content analysis using axial coding. Initially, there were 116 codes that were condensed into 28 codes and then nested within four emergent categories: field trip impact, lesson planning process, CAL/DL understanding, and influence on future teaching. Findings revealed that PSTs' perceived knowledge and evident application of knowledge are not always consistent. Additionally, the field trip impacted (both positively and negatively) the PSTs' overall experience in the course and their lesson plans. PSTs need more explicit instruction in the application of CAL and DL concepts, as PSTs often conflate the concepts and have limited success applying them in lesson plans. Although PSTs' reactions to the field trip experiences were mostly positive, PSTs acknowledged some confusion when integrating this context into the lesson plan assignments.

Keywords: preservice teachers, lesson planning, pedagogy, content-area literacy, disciplinary literacy, mathematics, science

Preparing the Next Generation of Mathematics and Science Teachers: Connecting Disciplinary Content to Literacy Through Experiential Learning

Literacy instruction is not isolated to the elementary or English language arts (ELA) classrooms but should be taught and integrated in all areas of instruction and disciplines. When secondary preservice teachers (PSTs) typically take the one required literacy course in their teacher preparation program, the course is usually a version of adolescent and/or content-area literacy. At this stage in their program, PSTs primarily focus on their discipline (e.g., art, ELA, mathematics, science, history/social studies, etc.). While secondary PSTs often understand the value of literacy instruction, they have limited knowledge and practice of applying literacy in their instruction. To further develop and support PSTs, experiential learning (e.g., field trips, practicum, etc.) provides valuable, hands-on, application and learning. Similar to previous research (Barry, 2012; Deroo, 2022), community partnerships such as museums can help PSTs “to move beyond the privileging of discrete language systems to extend awareness of learners’ multilingual and multimodal resources as a part of their integrated communicative repertoires” (Deroo, 2022, p. 227).

Researchers and teacher educators (Deroo, 2022; Moje, 2008) believe that PSTs should be exposed to and experience multiple learning environments, particularly due to the complexities of literacy practices (Barry, 2002). Also, researchers have suggested that teacher educators construct learning experiences that are designed to allow PSTs to learn, apply, and reflect in authentic learning experiences (Dewey, 1910/1993; Duffy & Atkinson, 2001). Furthermore, it is important to combine coursework with opportunities for ongoing written reflection (Yost et al., 2000). In this study, we focused our attention on both PST-developed lesson plans and written self-reflections.

Though written self-reflection is a valued practice in teacher preparation, few studies have investigated how the use of written reflection influences PSTs’ learning of literacy of CAL and DL concepts (Barry, 2002; Deroo, 2022). This study focused on the inclusion of CAL and DL instruction within mathematics and science PSTs’ lesson plans and written self-reflections, contextualized by common experiential learning opportunities in the context of a semester-long course. To guide this study, we posed the following three research questions:

- How do mathematics and science preservice teachers’ lesson plans demonstrate their knowledge and understanding of content-area literacy and disciplinary literacy after incorporating these concepts into lesson plans?
- How do mathematics and science preservice teachers’ written reflections demonstrate their knowledge and understanding of writing content-area literacy and disciplinary literacy lesson plans?

- How do field trip experiences impact mathematics and science preservice teachers' incorporation of CAL and DL into the lesson-planning process?

Literature Review

Literacy instruction is essential for students' immediate goals of academic advancement and their future roles as contributing members of society. The typical literacy instruction continuum, including recursive considerations, runs throughout K-12 schools: primary = literacy development, upper elementary = learning to read to reading to learn, and secondary = reading to learn more deeply. Compartmentalized learning highlights the need for cross-curricular, discipline-specific literacy (e.g., writing) instruction (Miller et al., 2018).

Specifically, content-area literacy (CAL) strategies enable students to begin incorporating literacy-based approaches to their learning *across* all content areas (Vacca & Vacca, 2002; Vacca et al., 2010). While CAL strategies facilitate students' learning more broadly and are useful in varied situations, disciplinary literacy (DL) approaches are embedded *within* each distinct content area (Shanahan & Shanahan, 2008, 2012). CAL and DL are distinct constructs, ideally; however, the relationship between the two is synergistic when DL builds specific applications from CAL's general engagement with the material. Lent (2016) crafts her approach to distinguishing the two via the prepositions used in the above descriptions: CAL engages *across* the content-area classes, and DL explores *within* each course differently. Thus, to strengthen teacher preparation and benefit future adolescent learners, secondary mathematics and science PSTs must understand and apply both CAL and DL instruction (i.e., reading and writing across and within the curriculum).

CAL strategies and DL practices also provide crucial support for adolescents' academic achievement, particularly college and career readiness. While mathematics and science disciplines primarily focus on content within the disciplines, many mathematics and science preservice and inservice teachers do not know, understand, or use CAL and DL concepts in content learning and 21st-century literacy interactions. Not all content-area teachers, including those who work with mathematics and science, have the skillsets or the mindsets to be literacy teachers (Alvermann & Moje, 2018; Fang & Robertson, 2020). Even if teachers do hold the belief that literacy is integral to teaching and learning in their content area (Cantrell et al., 2008), they may not have the knowledge or skills necessary to support students' literacy development in the classroom (Hall, 2005).

Demands on adolescent literacy increase in secondary schools (e.g., specialized vocabulary/discourses, discipline-specific informational texts, and increased cognitive demands), which means disciplinary teachers must have literacy expertise to support learners. The Common Core State Standards (CCSS) widely adopted or adapted across the U.S., state that secondary disciplinary teachers in ELA, mathematics, history/social studies, science and technical subjects "use their content area expertise to help students meet the particular challenges of reading,

writing, speaking, listening, and language in their respective fields” (CCSS, 2021, “ELA Standards” section, para. 4).

Literacy for Learning

To better understand discipline-specific literacy instruction for adolescent learners, we consider both CAL and DL. CAL is described as the student-centered approach of incorporating general reading and writing strategies in content-area classes to promote students’ learning of content-area information as well as skills and strategies (e.g., graphic organizers and Readers’ Theater; see Fisher & Ivey, 2005; Vacca & Vacca, 2005), whereas DL refers to specific discipline-specific practices and the integration of these authentic, content-specific literacy practices and knowledge as “the use of texts in their respective disciplines” (Colwell et al., 2021, p. 9) and “to the shared ways of reading, writing, thinking, and reasoning within academic fields” (Rainey & Moje, 2012, p. 73). According to Shanahan and Shanahan (2008, 2012), DL describes the advanced, specialized, and critical literacy resulting from embedded instruction in content-area classes; thus, DL supports learners with the application of strategies that are discipline specific. For example, in mathematics and engineering, students can develop digital or visual representations of a project. Each discipline has distinct discourses that teachers can leverage in content-area instruction to approximate authentic literacies for students. These CAL and DL perspectives each employ strategies and practices to further adolescent learners’ deeper content acquisition and critical thinking, whether more broadly in the context of literacy (e.g., reading and writing) or more specifically within the domains of specific disciplines.

To better understand how CAL and DL are put into practice, research must address two issues: incomplete teacher preparation and professional development in CAL and DL and the shift from historical roles and responsibilities that shape beliefs about literacy in secondary settings. Reviews of literacy instruction (e.g., Hall, 2005, Risko et al., 2008), have indicated that secondary-level, discipline-specific preservice and inservice teachers may not fully believe in, understand, and/or employ literacy practices in their teaching.

Content-Area Literacy Research

CAL research has found significant support for almost five decades now despite PST insecurity about applying CAL strategies. In the 1970s, content-area reading was the new hot topic for scholars (Herber, 1970, 1978). This trend followed in the 1980s with historical reviews (e.g., Moore et al., 1983) and investigations of teachers’ use of CAL (Gillespie & Rasinski, 1989). Similar research was conducted in the 1990s (see Bean, 1997; O’Brien & Stewart, 1990). More recently, published work investigates teacher preparation (Friedland et al., 2017) and CAL within discipline-specific classes (Armstrong et al., 2018). Armstrong et al. (2018) evaluated CAL instruction in a mathematics class, finding that literacy is an integral part of a student’s academic success and that they need to know and understand distinct approaches to literacy that can then be applied to discipline-specific classes. However, Sargent et al. (2018) examined the expectancy beliefs of secondary PSTs in relation to the fact they had not been trained to use and

integrate literacy into their instruction and found that teachers in their study expressed a lack of confidence for integrating literacy practices.

Disciplinary Literacy Research

Disciplinary literacy, while not new in terms of research and understanding, still lacks the level of application from teachers, educators, and even scholars as compared to CAL. Whereas CAL is general literacy instruction (e.g., strategies) used and applied across content areas, DL is specific to academic disciplines (e.g., biology, geometry, etc.) “as separate cultural discourse communities, each with their own ways of generating questions, pursuing investigation, and communicating and evaluating claims” (Kavanagh & Rainey, 2017, p. 907). More recent research on CAL and DL reveals that researchers consistently evaluate PSTs’ perspectives (Colwell et al., 2020; Enderson & Colwell, 2021). This lens echoes Bean’s (1997) work from the late 1990s, in which he described PSTs’ use of CAL strategies, but found when he followed them in the classroom as teachers, the variables differed. Though the focus of this research is on CAL and not DL, it is important to make the comparison of where the research was then and now, over 20 years later.

DL scholarship has increased in recent years (Brozo & Crain, 2018; Enderson & Colwell, 2021; Hayden & Eades-Baird, 2020, etc.), while Kavanagh and Rainey (2017) have issued a call for increased DL teaching. Teachers must have “deep and usable knowledge and skill” (Shaughnessy et al., 2016, p. 815); therefore, teacher knowledge is more than discipline-specific knowledge, it must be combined with pedagogical knowledge and specialized knowledge of students. For example, a mathematics teacher’s knowledge consists of more than mathematical knowledge, as it also includes “knowledge for teaching” that is specific to the discourses of mathematics (Shaughnessy et al., 2016, p. 815). These divergent examples demonstrate that research is continuing to develop and evolve, though it also highlights the need for continued research in DL more broadly and the intersections of teacher knowledge and pedagogy more specifically.

Teacher Preparation and Teacher Education

Researchers (Bean, 1997, Konopak et al., 1994; etc.) have recommended that K-12 preservice and inservice teachers gain more exposure to literacy instruction for both CAL and DL. Generally, secondary PSTs (undergraduate students) are required to take one CAL course as part of their teacher preparation programs, whereas inservice teachers (graduate students) typically are not required to take course(s) in this area or any other literacy area, unless it is the emphasis of a degree. For example, a science teacher might ask, “How do I teach writing in my class?” or “Why do I need to teach writing in my class?” According to Scott et al. (2018), “It is likely that teachers will lack the generative knowledge and skills to integrate literacy instruction when they only receive one content-specific methods” course (p. 9). Therefore, educator preparation programs should consider incorporating more than one content-area literacy course and—

whether as an addition to or as an enhancement of current course offerings—incorporate CAL and DL concepts throughout professional development and methods courses.

Present Study

This study examined mathematics and science PSTs' knowledge and application of CAL and DL. Their understanding of CAL and DL concepts was assessed using lesson plans and written reflections completed by the participating PSTs.

Course Context and Field Trips

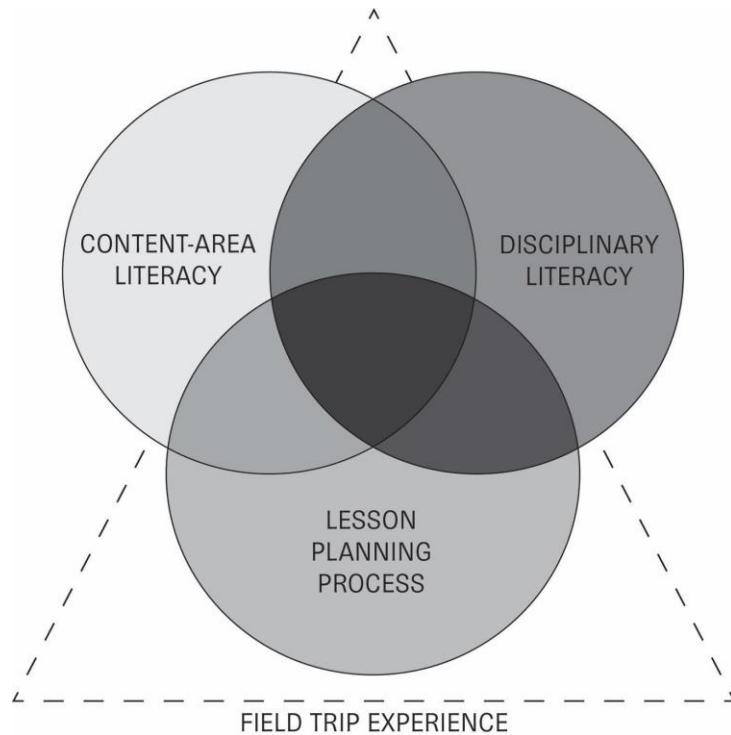
Participants, all of whom were secondary (intermediate and high school) single-subject PSTs, were enrolled in a semester-long undergraduate literacy course on strategies for developing comprehension and critical reading and writing in discipline-specific instruction. The face-to-face course is the one required literacy course at a university-based teacher licensure preparation program located in the southwest United States. Participating students from the larger study included 27 students from five disciplines (i.e., art, ELA, mathematics, science, and history/social studies). For the purposes of this study, we focused on the experiences of the mathematics and science PSTs.

Course instruction was informed by current research in the field and was aligned with the Interstate Teacher Assessment and Support consortium (InTASC) Standards and International Literacy Association (ILA) Standards. In addition to other course instruction and assignments, the class also participated in two field trips. First, they visited a museum and second, they visited a recycling center. From the two field trips, they used their experiences and discipline knowledge to develop two lesson plans for each event, the first one focused on CAL strategies and the second on DL practices.

Additionally, class readings helped define CAL and DL options with authentic experiential experiences (field trip) building capacity throughout the semester, all of which was followed by written reflections to capture and demonstrate growth. Through experiential learning (Kolb, 1984), the individual learns through lived experiences. Figure 1 visually represents the conceptual model used for lesson plan designs and course instruction.

Figure 1

Conceptual Model for Lesson Plans



Participants

Purposive sampling (Patton, 2002; Onwuegbuzie & Collins, 2007) was used to recruit participants for this study. According to Onwuegbuzie and Collins (2007), for purposive sampling, non-probability sampling is used to target specific groups of participants. Thus, sampling was purposive to examine PST knowledge in the context of a CAL/DL course that also had connected field trips (i.e., art museum and recycling center) in a semester-long course specifically designed to cover CAL strategies and DL practices. Permission from the university through the Internal Review Board and participants (i.e., consent) was obtained and data was analyzed following the completion of the courses after grades had been reported.

Twenty-seven PSTs were enrolled in the course and twenty-five PSTs consented and participated. Of the twenty-five PSTs, five ($n = 5$) were majoring in mathematics ($n = 2$) and science ($n = 3$). Data (i.e., lesson plans and written self-reflections) from mathematics and science PSTs were included and analyzed. Participants were all seniors (in their final academic year/semester of the program) and ranged from 20-25 years old. Four identified as female and

one identified as male. All participating PSTs were in a practicum and/or student teaching as part of their program requirements.

Data Collection

A total of 18 lesson plans and nine written reflections from five participants were collected and analyzed for this particular study. As part of course assignments, each participant was assigned to write four lesson plans each, though one student did not complete the first round of lesson plans or reflection, resulting in a total of 18 lesson plans and nine reflections. All participants used a university-required lesson plan template to guide their format, a template which included the following components: standards (e.g., Common Core State Standards [CCSS], Next Generation Science Standards [NextGen], National Art Standards from the National Art Education Association [NAEA], etc.), teaching model, objective, materials/technology, instructional procedures (motivation, developmental activities, closure, extension), accommodations/modifications, assessment and evaluation, extension (homework), and reflection of the lesson if taught. After writing each set of lesson plans, PSTs wrote a self-reflection that focused on successes and challenges during the lesson planning process. PSTs were encouraged to include justifications for their perceived understanding of CAL and DL concepts.

Data Analysis

To answer the research questions guiding this case study (Stake, 1995), we examined secondary mathematics and science PSTs' knowledge and application of CAL and DL through lesson plans and written self-reflections. Lesson plans were rooted within common experiences (two field trips) and an original rubric was used to analyze the lesson plans. Eighteen lesson plans were analyzed using a rubric developed by the research team, reflections were analyzed using content analysis, and axial coding was used to analyze TCs' reflections upon their LP experiences (Berg, 2001).

Rubric

The original rubric underwent multiple iterations as the team sought to create the best tool to capture PSTs' accuracy, knowledge, and understanding of developing lesson plans and sampling CAL and DL concepts within their instruction. The final iteration of the rubric was used to evaluate the quality of each element of the lesson plan (see Table 1). A three-point scale was used for each criterion with one point denoting little to no evidence and three points demonstrating consistent presence/implementation.

The first part of the rubric assessed the presence of foundational elements (e.g., objectives, standards, etc.), instructional procedures (e.g., activities), and extension components (e.g., assessment, modifications) in a lesson plan. The second part of the rubric focused on how PSTs incorporated their field trip experience into the planning. The third part of the rubric consisted of

a choice between a CAL section and a DL section. CAL lesson plans were assessed using the CAL criteria, while DL lesson plans were evaluated using the DL criteria. Because the tenets of CAL and DL are fairly distinct, the scale reflected these differences in the respective sections.

Table 1

Lesson Plan Rubric

Category	1 ranking: Little or no evidence of implementation	2 ranking: Evidence of emerging implementation	3 ranking: Evidence of consistent implementation
Quality assessment of lesson plan <i>Use the following descriptions for both types of lesson plans.</i>			
Lesson plan contains required <i>foundational</i> elements (i.e., state standards, teaching model, objective[s], and materials/resources) that are relevant to lesson implementation and outcomes.			
Lesson plan contains required <i>instructional</i> procedures (i.e., introduction, activities or learning experiences, closure, and extension/contingency plan) that are connected explicitly to stated foundational elements.			
Lesson plan contains required <i>extension</i> components (i.e., accommodations/modifications, assessment/evaluation of learning, homework assignment, and post-lesson reflection) that demonstrate content acquisition beyond instructional procedures.			
Field trip experience(s) <i>Use the following description for both types of lesson plans.</i>			
Field trip experience provided inspiration for lesson plan content.	Field trip experiences <i>were not addressed</i> within the lesson plan.	Field trip experiences <i>were addressed but were not incorporated</i> meaningfully within the lesson plan.	Field trip experiences <i>were addressed and incorporated meaningfully</i> within the lesson plan.
Content-area literacy <i>Use the following description for CAL lesson plans.</i>			

Category	1 ranking: Little or no evidence of implementation	2 ranking: Evidence of emerging implementation	3 ranking: Evidence of consistent implementation
Lesson plan incorporates effective literacy-based resources/strategies to assist students in content acquisition/application <i>across</i> the disciplines.	Literacy strategies <i>are not included</i> within the lesson's goal of content acquisition and/or demonstration.	Literacy strategies are <i>included but are not incorporated meaningfully</i> within the lesson's goal of content acquisition and/or demonstration.	Literacy strategies are <i>incorporated meaningfully</i> within the lesson's goal of content acquisition and/or demonstration.
CAL strategy	No CAL strategy selection/specified	CAL strategy selected/specified	CAL strategy selected with evidence of implementation
Disciplinary literacy <i>Use the following description for DL lesson plans.</i>			
Lesson plan provides students with effective literacy-based approaches (e.g., evaluation/ production of discipline-specific texts with attention to source, purpose, and audience; see ILA framework; Shanahan & Shanahan, 2008; Masuda, 2014) to assist them in content acquisition/ application <i>within</i> the disciplines.	Discipline-specific literacy approaches <i>are not included</i> within the lesson's goal of content acquisition and/or demonstration.	Discipline-specific literacy approaches are included but <i>are not incorporated meaningfully</i> within the lesson's goal of content acquisition and/or demonstration.	Discipline-specific literacy approaches are <i>incorporated meaningfully</i> within the lesson's goal of content acquisition and/or demonstration.
DL practice/concept	No selection of specific DL practice/concept	DL practice/concept present	DL practice/concept present with evidence of implementation

Scoring of the lesson plans occurred in two phases. In phase one, two of the researchers coded the lesson plans separately using the existing coding rubric. Each researcher read and reread all of the lesson plans submitted by each participant and then coded via the rubric. This process was repeated for each of the mathematics participants. Both researchers followed the same process and coded each participant's lesson plans in the following order: lesson plan one in CAL, lesson plan two in DL, lesson plan three in CAL, and lesson plan four in DL. This process was then repeated for the lesson plans for each of the science participants.

During phase two, the two researchers met virtually to discuss the individual coding results. Codes were compared for each lesson plan for the mathematics and science participants. Next, discrepancies between scores were discussed. If scores differed on a rubric item, the team would

revisit the lesson plan and discuss the score, ultimately coming to an agreement for the final item score. This process was repeated for all rubric items in each lesson plan.

Written Self-Reflections

For the course assignments, the PSTs completed two written reflections. These self-reflections asked the PSTs to reflect on each experience, the field trip, the lesson plans, the process, the similarities and differences between the two lesson plans (CAL & DL), and how they may or may not influence literacy instruction with the context of content instruction. Similar to the lesson plan, as part of the larger study members of the research team selected three PSTs and independently read both self-reflections. Responses were initially coded based on each individual unit of thought (Berg, 2001). After independent coding, the researchers discussed code names and variation in definitions. Initially, 116 codes were created. Upon further discussion, the code book was condensed while still maintaining 100% agreement on code definitions. This discussion resulted in a reduction of the code book to 28. Using axial coding, four conceptual categories were created, and the 28 codes were nested under a particular category (Berg, 2001; Strauss & Corbin, 1998). These four categories were: field trip impact, lesson planning process, CAL/DL understanding, and influence on future teaching.

Findings

In this study, mathematics and science PSTs' lesson plans and self-reflections were used to gain a better understanding, knowledge, and experiences of CAL, DL, with embedded field trips. Scoring rubrics with descriptive data and quantitative analysis revealed that PSTs in general believe they have a better understanding and application knowledge of CAL rather than DL. However, the lesson plans revealed that their knowledge of CAL was limited, lacked details, and was not always coherent or fully developed. Conversely, the DL lesson plans were thorough and applied DL concepts within mathematics and science instruction to help their students deepen their knowledge of the disciplines. Some PSTs continued to confuse the CAL and DL concepts, using them interchangeably. Additionally, the written self-reflections provided further understanding of the PSTs' contextualized learning throughout the process and revealed themes for analysis.

Lesson Plans

PSTs used the department's required lesson plan template. On the initial elements of the lesson plans as detailed in the assignment rubric (see Table 1), PSTs had a good foundation, on average, for lesson planning, including foundational elements, instructional procedures, and extension components. Using descriptive data, the PSTs' scores for the lesson plan elements met and/or exceeded expectations, with overall averages ranging from 6.9 to 8.29 on a 9-point scale. There was a slight difference between the CAL and DL sets, though. CAL lesson plans averaged 13.29/18.00, whereas DL lesson plans were 15.29/18.00. In rereading the lesson plans it was noted that these differences possibly contributed to the number of details PSTs included into

their lesson plans. For example, the CAL lesson plan would include the strategies, with a basic knowledge that students and teachers would understand the literacy practice and less details were needed to describe it. In contrast, the DL lesson plans required more in-depth information to demonstrate the concept within the lesson topic from the discipline.

Overall, the PSTs have an understanding and knowledge of lesson planning and were able to construct a cohesive instructional sequence. Although differences were noticeable between the types of lesson plans, PSTs demonstrated general lesson plan knowledge. Lesson plans were further analyzed for PSTs' knowledge and understanding of CAL and DL concepts. To better demonstrate the lesson plan assignment, Appendix A includes one CAL lesson plan, and Appendix B consists of one DL lesson plan.

Content-Area Literacy

The PSTs in this study continued to have limited knowledge and understanding of CAL and how to apply CAL strategies within their discipline-specific instruction. Rubric scores averaged 3.75, these scores demonstrated that PSTs have a limited understanding and lacked details and evidence in the lesson plans that would allow the students to apply literacy strategies to their discipline. One example from a mathematics PST is how they would describe the mathematics concepts to answer a formula and then extend that process through the CAL strategy of having the students compose a journal entry or write down the steps to answering the formula. Another student used an Exit Ticket at the conclusion of the lesson but did not provide how this strategy would help them as the teacher or the students to learn from the lesson. The two mathematics PSTs presented limited CAL knowledge in their lesson plans, whereas the science PSTs included more details about CAL and explicitly stated the strategies (e.g., Jigsaw) that would be used and how it supported the instruction in the lesson plan. However, the use of literacy strategies was not consistent and the understanding of how to apply the strategies into the instruction was still limited.

Disciplinary Literacy

According to the rubrics, there were notable differences in the scores between the CAL and DL lesson plans. PSTs demonstrated a better understanding of the DL concepts. Overall, both the mathematics and science PSTs exhibited an understanding of DL and how to apply the concepts within their lesson plan. There was also no distinct difference between the two disciplines. Examples of DL included having students use specific scientific tools to have the students explore, measure, and calculate. Students would also conduct research on discipline topics, becoming more familiar with the lesson plan (e.g., how to develop a garden, interviewing community members and/or experts on questions pertaining to the science of gardening). The mathematics PSTs used tangible manipulatives to design and construct buildings, making precise calculations, and following up with a brief written report of the findings. PSTs in both disciplines

provided more explicit details in their lesson plans, while affording students the time to not only learn about the concepts but also to research and apply their knowledge through practice.

Written Self-Reflections

As part of a bi-weekly, semester-long course, the course included instructional lessons, activities, pedagogical examples, readings, etc. to support adolescent literacy instruction within the specific disciplines. PSTs also engaged in hands-on activities, presentations, discussions, and two field trip experiences. Although scaffolding was provided for the content, the PSTs continued to demonstrate confusion or a lack of understanding for CAL and DL and, more importantly, how they would apply these literacy strategies and practices in their lesson plans. At the completion of the writing of the two sets of lesson plans, each student was directed to write two reflections, one for each set of lesson plans and field trip experience. After the reflections were coded, four categories of themes emerged: field trip impact, lesson planning process, CAL/DL understanding, and influence on future teaching.

Field Trip Impact

In planning the course, Barry's (2002) research was used as an example of why and how to integrate field trips, particularly the use of art into course instruction. During the course introduction, PSTs were surprised they would be going on field trips, yet skeptical of how such experiences would connect their learning to literacy instruction and lesson plan development. One student stated, "Going into the 'field trip,' I had some idea what was expected, but I struggled to find a connection." In preparation, the PSTs were assigned to read the Barry article, and course participants discussed how discussed how this may or may not look in the course.

Similar to the Barry article, this particular study included field trip experiences that were designed and implemented to provide PSTs with contextual experiences to inform their instruction. Though the PSTs did not always articulate their confusions, the art field trip raised questions. For example, one science PST only expressed uncertainty when they felt a communal reinforcement:

It was nice to see that others were just as confused about this whole "art inclusion" assignment as I was; after all, it's much harder to admit one's shortcomings if you feel like you're the only one who has them.

The field trip experiences and the DL lesson plans were interconnected, and although these factors were sorted into separate categories within the research, the reflections yielded insight about the PSTs grasp of and level of engagement with DL. Similar to the science PST quote above, other students reiterated their resistance or lack of connection, such as "Let me first start off by saying that the idea of including artwork in any biology lesson plan had me less than thrilled" and "In fact, I truly hated the thought of blending these two subjects." Although this student was not convinced of this activity, they did grasp the concepts. When their reflection was

compared to their lesson plans, analysis revealed that they demonstrated a keen understanding of both CAL and DL and appropriately incorporated the concepts within their lesson plans.

As a whole, the PSTs also made comparisons between the two experiences, “The field trip to the art museum allowed students to have several pieces of art to get inspired by, there was mostly only our guest speaker’s story [for the recycling center].” This issue resulted in more challenges with developing lesson plans around the ideas and/or field trip experiences. Overall, PSTs liked the idea of the field trips. The idea of “going” on a field trip in college was a new and innovative concept, one many of them had never had. However, due to challenges with understanding the purpose, concepts, weather, and positive feedback and criticisms (Barry, 2002), there is room for improvement. The reflections demonstrated that the PSTs’ reactions to the field trip experiences were mostly positive; but they acknowledged some confusion when integrating this context into the lesson plan assignments.

Lesson Planning Process

Whereas other PSTs were excited about the experience and were able to make quick, concrete connections to the art and their lesson planning. One mathematics PST shared their thoughts about some of the art from the museum:

Immediately, I made a joke of how it looked like a design that came out of the game Minecraft, which my friends used to play. Not knowing I would end up coming up [with] an idea for a lesson, I found myself liking the piece of art because of how I could relate to it. Not only did it bring up great memories of my friends, but it was simple enough to see how I could find the volume of it by multiplying its length, width, and height together.

The student also wrote, “The content area literacy lesson came naturally as I was just going to teach how to find the volume of a rectangular prism,” and “Focusing on the students helped me create an exciting lesson that has students relate volume to actual constructions in real life.” When cross referencing this PST’s lesson plans with their written reflections, their accuracy of developing a DL lesson in connection to their reflection was correct, but their CAL lesson plan lacked key details and a clear understanding.

Another science PST was able to use web pages (i.e., hhmi.com and newsela.com) “to tailor each lesson to fit the idea of either CAL or DL.” They shared that “overall, I found completing this second assignment was slightly easier than the first.” However, they also stated:

‘Why are we doing this?’ I understand that it is an attempt to condition my mind to ‘think outside the box,’ but unless I was forced to use the art and/or the recycling center directly in my lesson plan; I didn’t really know why I had to make these difficult connect[ion]s.

PSTs often grappled not only with developing the lesson plans, but how to integrate the ideas and experiences from the field trips, in addition to the connection to literacy strategies and

practices. As teacher educators, it is important to provide PSTs with tangible experiences. But also, it is important that PSTs first demonstrate a foundation for the content and application. Another science PST wrote, “Don’t misunderstand, I really love art, but I loathed the idea of convoluting scientific concepts with abstract and irrelevant ideas.” This idea of making multiple connections was part of an ongoing dialogue with the instructor and the class. But the PST concluded her reflection by writing, “Still, I found the assignment entertaining and fun.”

Although a small sample, the nine reflections discussed the excitement and/or apprehension of field trips, but the majority of their reflections were on the process of lesson plan writing. They shared their ideas, thoughts, and how they would teach and implement the lessons. Furthermore, they made connections between the first set of lesson plans and how they were challenged more by the second field trip but were able to seek more help from their instructor and peers.

Additionally, one student wrote:

I learned that in order to be successful in applying what I am learning about content area literacy, I need to be applying it on a daily basis, in every lesson. If it is a part of the routine, it will help the students to get used to discussing terms, definitions, meanings, and drawing inferences on the lesson that they are about to learn.

CAL/DL Understanding

The most prominent pattern within the category of CAL/DL understanding was a clear misunderstanding of literacy concepts, specifically those related to CAL. In nearly all of these cases, the PST incorrectly labeled DL concepts as CAL. For example, one PST said, “The content area literacy lesson came naturally as I was just going to teach how to find the volume of a rectangular prism.” Since that concept is specialized within math instruction, it is not a CAL concept. Another math PST stated their CAL lesson plan objective was “to measure the relationship between the arc length of an angle and the angle itself.” Once again, that concept is specific to math (and some areas of science), which means it does not fit the definition of content area literacy. In an almost poetic way, this PST’s reflection displayed a high level of confidence in justifying the lesson as CAL despite contradicting themselves in the same reflection by stating, “I feel like it was very difficult to keep from making both of the lessons disciplinary literacy.”

Another pattern worth noting was how a lack of CAL understanding led to flawed conclusions about its purpose. One science PST took a dyspeptic view of having to use CAL strategies at all and said, “Not to say I wouldn’t have my students read, obviously they’d have to, but I feel like it’d be much more likely that I’d teach a lesson about an actual science standard that just happened to include general literacy, not center an entire lesson around it.” Another science PST took a less antagonistic stance and was rather frank in describing how they were “having difficulty unwinding [the CAL/DL difference] though, I don’t feel like I have enough of a grasp on the topic to be able to reason my way out of it.” What these PSTs have yet to realize is that CAL strategies are used to help students access the DL of a lesson, which is usually what leads

to mastering the standard. The CAL strategy itself is just that, a strategy. It is not necessarily a standard.

While CAL misunderstandings were frequent, DL misunderstandings were rarer. Since nearly all of the PSTs tended to write DL-centered lesson plans in the first place, many of them had a clearer understanding what DL concepts were within the context of lesson planning, though this was not evident in class discussions. For example, one science PST, though, missed the mark entirely in thinking they “did a great job implementing different teaching models that focused more on the students.” This PST was under the impression that DL concepts were about instructional delivery and not the discipline-specific concepts that students need to master per state standards. Again, as stated before, instances like this one did not occur often.

Influence on Future Teaching

For as much misunderstanding as there was about the differences between CAL and DL, the PSTs actually had a positive outlook on how the two ideas would influence their teaching. One math PST admitted, “I try to focus too much on disciplinary literacy in the classes that I teach and not enough on content area literacy … I will very likely modify my routines to make sure that I am properly balancing both literacies in my instruction.” Another math PST echoed these sentiments but from the student perspective: “Because of the difference in the skills they teach students, both [CAL/DL] are needed to provide the best education for students.”

One case worth noting was that of a science PST who initially displayed clear misunderstandings about CAL/DL only to show some emerging clarity when describing how this particular assignment would affect their teaching:

Both content area literacy and disciplinary literacy are important and have their place in the classroom … Content area literacy is more of a struggle for me, but vocabulary is a very important part of science. I think that making the vocabulary more meaningful to the students is important.

By the end of the assignment, this PST did eventually write a lesson plan with proper implementation of CAL strategies, thereby showing a better understanding of the CAL/DL dichotomy than most of their peers in the course. Their progress was an example of a PST reflecting on their own misunderstandings and then taking steps to rectify those misconceptions along with the aid of instructor feedback. Not all students in this course necessarily followed that path.

Recommendations/Implications for Future Teachers

As teacher educators, we continue to ask and/or push our PSTs as learners to be the best teachers they can be as they are striving to understand not only their disciplines but also their students and their needs. Likewise, we need to improve our own practices. We certainly acknowledge the

value of field experiences, in this case the two field trips, yet we question the necessity of them and examine the tangible learning opportunities provided for PSTs. Similar to Barry (2002), who reflected on her course and the “art experience” to determine whether to continue including it, we have considered our practice and still find value in the content, as well as the field trip experiences, while acknowledging that modifications are needed to the overall process and the assignments.

Incomplete Teacher Training and Professional Development

No matter the discipline (e.g., ELA, math, science, and social studies), PSTs need time and support both to write effective lesson plans and to apply and reflect on the process. Moreover, PSTs need more explicit instruction in the application of CAL and DL concepts, as PSTs often conflate the concepts and have limited success applying them in lesson plans and in their instruction.

By examining lesson plans and written self-reflections from secondary discipline-specific PSTs, it is noted that additional literacy support, such as CAL and DL, is needed. Researchers (Darling-Hammond & Young, 2002; Scott et al., 2018) assert that preservice and inservice teachers need appropriate training to teach literacy in general but more explicitly in discipline-specific classes.

The Historical Shifts Shaping Beliefs

Prior to focusing on teacher preparation and instruction, however, we need to revisit the research on literacy instruction, specifically CAL and DL, to explore/investigate the extent to which that research is being reflected in today’s secondary-level, discipline-specific classrooms; therefore, school systems should focus professional development initiatives on writing more effective CAL- and DL-based lesson plans. When teacher preparation programs and school systems better establish the value of reading and writing across grade levels and disciplines, using more effective CAL- and DL-based lesson plans, then the stance of “every teacher a literacy teacher” will gain more traction and acceptance across all content areas.

Conclusion

Regardless of the motivations behind literacy education research, “ensuring rich literacy instruction for all young people is a challenge because it requires sophisticated instructional practice on the part of teachers” (Kavanagh & Rainey, 2017, p. 905). As schools, classrooms, and students continue to change, literacy instruction also changes. Consequently, the need for ongoing literacy research remains constant. DL has gained traction only recently in a long history of CAL research (Moje, 2008; Shanahan & Shanahan, 2008). Notwithstanding CAL’s long trajectory in education (e.g., Banton Smith, 1934, 1986; Scott et al., 2016), the research on CAL and DL has not reached the same levels of density and systematic nature as that of more traditional literacies, such as fluency or phonemic awareness. Thus, our understanding of the

work of literacy instruction in secondary discipline-specific classrooms is not as robust within the established scope of literacy research.

In conclusion, the inherent complexities of literacy are further nuanced by the concepts of CAL and DL, a fact that impacts PST and teacher understanding of literacy integration, specifically within the constructs of disciplinary instruction. The inclusion and evaluation of CAL and DL concepts in PSTs' lesson plans is a way to build and bridge teacher knowledge of literacy instruction and is a tool for revealing misunderstandings PSTs may have about literacy concepts. Thus, we encourage teacher educators and educational researchers to join us in the continued exploration of incorporating CAL and DL experiential learning into literacy teacher preparation in efforts to inform both practice and policy.

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Appendix A

Content-Area Literacy Lesson Plan Example

<u>Biology/Freshman</u> Subject/Grade Level	<u>Natural Selection</u> Lesson Topic	<u>50 minutes</u> Estimated Time
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1. Standards

HS-LS4-4. Construct an explanation based on evidence for how natural selection leads to adaptation of populations.

2. Teaching Model

- Direct instruction- *Students will receive direct instruction at each step of the jigsaw activity.*
- Cooperative Learning- *Students will work in groups of 4-5 to complete the assigned readings. Students will use the jigsaw teaching strategy to teach their peers.*

3. Objective(s)

- By the end of this lesson, students will be able to explain how natural selection leads to adaptation of various species.

4. Materials/Resources

Teacher resources:

- Overhead projector
- Teacher's computer

Student resources:

- Student laptops (one per student, provided in the classroom)
- Access to newsela.com website. (6 links provided on google classroom, one for each reading. See links below) (students have already established an account)
- Paper (one sheet per student)
- Pencils (one per student)
- Access to <https://youtu.be/M3bROOvWMcM> video (Link provided on goggle classroom)
- Six cards, each with a different article written on it. (Four sets. One set for each "home group")

5. Instructional Procedures

Steps: This standard was broken up into a number of steps and utilized multiple examples.

Leading up to this lesson, students completed the following:

- 4/5: Students completed the in-class gizmo assignment involving the peppered moth.
(Introduction to HS-LS4-4 standard)

- 4/6: Students looked at camouflage as a favorable trait found in various animal species.
(Specifically: octopi and chameleons)
- 4/9: Students watched the video on pocket rock mice and took the online quiz as a class.
(Students introduced to gene variations)
- 4/10: Students took guided notes on Natural Selection and identified key elements.
(Students learn the components of natural selection and vocabulary)
- **4/11/ (this lesson):** Students will read about different organisms and will identify 1-2 adaptations that helped or hindered this organism's ability to be "successful". Students will then link these real-life examples to the idea of natural selection. Using jigsaw, students will learn and then teach their peers about the various articles covered. Students will discuss and share their thoughts and ideas surrounding the natural selection topic as stated above.

Management issues:

- For this lesson there will be four transitions:
 - First transition: Will take place between the warm-up question and the First step of the jigsaw activity. Students will discuss their answers to the warm-up question and will refresh their memory on what it means to be "successful" in nature.
(Specifically: That animals need to survive and reproduce and that some animals are naturally selected to live while others are not)
 - Second transition: Will take place between the first step of the jigsaw activity and the second step. After selecting an article, students will get into their "learning groups" where they will first read the short article and then discuss the important points of the article with their "learning group" peers.
 - Third transition: Will take place between the second step of the jigsaw activity and the third step. Students will get back into their "home groups" and take turns teaching their peers about the articles they read. Students will be given time to pick out 1-2 adaptations and will identify how these articles relate to natural selection.
 - Fourth transition: Will take place between the third step of the jigsaw activity and the final step. Each group will be asked to share the adaptations they identified for each article with the class. Students will also discuss how they think natural selection played a role in each article. This discussion will serve as the closure for today's lesson.
- In order to avoid other management issues, students will receive a number as they enter the room. This number will be between one and four. This number will establish the "home group". Home groups will contain no more than 6 individuals. Once students have gotten into their home group, they will receive the name of an article that they will become "experts" on. Students can find these names on the four home group tables. Students will be given 2 minutes to establish which article they will read and teach to

their home group. In order to avoid confusion, instructions will be provided at every step of the activity. There are exactly four steps in today's activity.

Technology uses:

- Students will use their individual laptops to access the warm-up question and the newsela articles needed for the lesson.

Student Learning:

- Today's lesson will allow students to learn via cooperative learning and direct instruction. Important information will be provided visually, orally and physically for all learning styles. Student understanding will be assessed periodically using classroom discussions to ensure that students understand the new content. This will be the fifth lesson covering natural selection. Students will make connections between the idea of natural selection and an animal's ability to be "successful" by learning about real world examples.

A. Introduction (5-7 min)

- Students will arrive and begin working on the warm-up.
 - o Warm-up: Students will watch the video <https://youtu.be/M3bROOvWMcM> and will answer the following question on google classroom:
What is one physical trait that helped Lithipodius nella survive in its environment?

- After the first five minutes: Students will share their answers to this question.
 - o (Traits that should be identified: body color, body shape, body size and speed)
- Students engage in a teacher led discussion about what made Lithipodius nella able to evolve.
 - o (Specifically: gene variations, environmental pressures, survival and reproduction)

B. Activities or Learning Experiences (35-40 min)

- Students break into their "home groups", established by the number they received as they entered to room. (ex. all students with #1 go to table one) (1min)
- Students locate and discuss the six different articles. Each student will select one article which they will become "experts" on. (2 min)
- Students break into the "learning groups". Each group is reading and learning about one of the six articles listed below. Students will pick out the most important information for the article to share with their "home group." Students will record this information on a sheet of paper using a pencil. This sheet of paper will be submitted at the end of class to establish participation for the day. (20 min)
 - o *Scientists try to unravel the mystery of a butterfly's mimicry.* By: L.A. Times <https://newsela.com/read/butterfly-genes/id/3050/>
 - o *Sloths are lazy tree dwellers in Costa Rica-for Good Reason.* By: Scientific American <https://newsela.com/read/sloths-laid-back/id/20396/>
 - o *Everyday Mysteries: Why most male birds are more colorful than females.* By: Scientific American. <https://newsela.com/read/loc-mysteries-male-birds-more-colorful/id/26088>

- *Animals are lots bigger than they were millions of years ago, study shows.* By: San Jose Mercury News. <https://newsela.com/read/evolution-animalsbigger/id/7633/>
 - *Scientists study Persian Gulf reef for coral survival clues.* By: Scientific American. <https://newsela.com/read/persiangulf-coral/id/7783/>
 - *Scientists find virus killing millions of sea stars along Pacific Coast.* By: San Jose Mercury News. <https://newsela.com/read/starfish-death/id/6078/>
- Students get back into their “home groups” and take turns teaching their peers about the articles they read. Students pick out 1-2 adaptations and link the idea of natural selection. (10-12 min)
 - “Home groups” pick one article to share with the class. Once shared, the article cannot be discussed by another group. Home groups will share the identified adaptations and how their article relates to natural selection. (5 min)
 - NOTE: The teacher is circulating the class during the majority of this lesson to ensure that students are actively engaged and on the “right track”.

C. Closure (3-5 min)

- Students will answer the following question on an exit ticket:
 - *Please explain one way natural selection leads to changes within a population and use an example from today’s readings.*

D. Extension/ Contingency Plan

- Should time remain at the end of the lesson:
 - Students will share their exit ticket answers. Students will explain why they selected that answer and how it relates to today’s lesson. Incorrect answers will be discussed and clarified.
 - Students will answer the quiz questions found at the end of each article.
- If this lesson goes poorly, the following video will be used as a contingency plan: <https://youtu.be/aDIQFQOCGaI>.
 - Students will write a C.E.R. (claim, evidence and reasoning) statement on why the salamanders of California have adapted to look so differently.

6. Accommodations/Modifications

- ELL students may use translation technology in this lesson.
- If necessary, students may work in alternative groups; however, students must demonstrate a viable reason for this change.
- When specified, students with an IEP and/or 504 plan will be given additional time and/or assistance to complete the required readings.
- Instructions will be provided at each step of today’s activity.
- Students may alter the reading level on the newsela website to fit their individual reading needs. The reading level ranges from 1210L (12+) to 680L (4th -6th reading level).

7. Assessment/Evaluation of Learning

Formative:

- Students will submit an exit ticket prior to leaving the classroom.
- Students will provide verbal answers to in class questions.
- Students will make and share connections between today's readings and the idea of natural selection. This assessment will be done verbally as a group.

Summative:

- Students will take an exam at the end of the following week. This exam will cover this material and the rest of the material covered in this unit.

8. Homework Assignment

- Students will study their notes for the upcoming exam.

9. CAL/ DL Connection and fieldtrip connection:

- This lesson is considered CAL because it requires students to use reading and writing skills found across many disciplines. These skills include, but are not limited to:
 - Fluency
 - Decoding
 - Summarizing
 - Recording

For this lesson, students will need to call upon their most basic reading and writing skills in order to gain new information. This new information will then be applied to what they have already learned about natural selection. Unlike the DL lesson plan, this lesson plan does not require students to use skills found only in the science discipline.

My connection to the fieldtrip has to do with “survival of the fittest.” Just as Tara had to adapt to various obstacles to “survive,” so too do animals.

Articles that would be used in class:

“Scientists try to unravel the mystery of a butterfly's mimicry” By Los Angeles Times, adapted by Newsela staff

Big Idea: mimicry is found all throughout the animal kingdom and is often highly selected for by environmental pressures. Animals that mimic other plants and animals often do so to avoid being eaten. This allows them to live longer and pass on their genetic material, thus demonstrating natural selection.

“Sloths are lazy tree dwellers in Costa Rica — for good reason” By Scientific American, adapted by Newsela staff

Big Idea: The three-toed sloth has the ability to conserve more energy than its two-toed counterpart. This is due to decreased environmental pressures and genetic variations in the sloth's DNA that allow its body to function at a lower metabolic rate. Over many

centuries, the three-toed sloth's slower metabolism was selected for as a means of survival.

"Everyday Mysteries: Why most male birds are more colorful than females" By Scientific American, adapted by Newsela staff

Big idea: Sexual selection is another example of natural selection. Males who mate with the most females are able to pass more of their genetic material on to the next generation than male who fail to attract the same number of females. This repeated use of sexual selection helps maintain the sexual dimorphisms of males and females in many species. As long as females continue to select males who possess the most robust characteristics, then nature will continue to allow these traits to proliferate even though they may not help males avoid predators.

"Animals are lots bigger than they were millions of years ago, study shows" By San Jose Mercury News, adapted by Newsela staff

Big Idea: Genetic variations within a species allow some animals to become larger than others in the same species. Over time, natural selection has "chosen" the larger animals over those who were smaller. This has led to an overall change in the size of certain species over time.

"Scientists study Persian Gulf reefs for coral survival clues" By Scientific American, adapted by Newsela staff

Big idea: Some coral have the ability to withstand increased temperature changes. This is due to a genetic variation within the population. As environmental pressures change and the oceans become warmer, those coral that carry this genetic difference are able to adapt to the changing conditions. This coral are being "selected" by nature.

"Massive sea star die-off in Pacific Ocean linked to mystery virus" By Paul Rogers, San Jose Mercury News

Big Idea: As viruses evolve, they are able to infect a wider variety of animals. This ability to evolve is driven by natural selection. Those viruses' that can infect more hosts are more likely to proliferate. This is an example of a non-living "organism" being selected for by environmental pressures. One could also examine the idea that the star fish are being selected against in the article.

Appendix B

Disciplinary Literacy Lesson Plan

<u>Biology/Freshman</u> Subject/Grade Level	<u>Natural Section</u> Lesson Topic	<u>50 minutes</u> Estimated Time
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1. Standards
HS-LS4-4. Construct an explanation based on evidence for how natural selection leads to adaptation of populations.

2. Teaching Model

- Direct instruction: *Students will observe one video as part of the warm-up and will receive verbal instructions on how to complete today's assignment.*
- Inquiry: *Students will use guided inquiry to complete the hhmi lizard evolution virtual lab. Students will first observe different traits found on closely related species of lizards. Students will inquire as to why there are so many variations of lizards within the same "habitat". Students will collect data and reason why these favorable traits were selected (via natural selection).*
- Cooperative learning: *Students will work together to complete the virtual lab and worksheet.*

3. Objective(s)

- By the end of this lesson, students will be able to identify the various adaptations of *Anolis* lizards.
- By the end of this lesson, students will be able to explain how natural selection leads to adaptation of species.

4. Materials/Resources

Teacher resources:

- Youtube Videos:
 - o <https://youtu.be/M3bROOvWMcM> (how natural selection works)
- Teacher's copy of the handout with answers
- Overhead projector
- Whiteboard
- Dry erase markers (3) and eraser (1)

Student resources:

- School provided student laptops (one per student)
- Natural selection notes from the previous day (one per student)
- 32 Lizard evolution Virtual Lab worksheets
- Pen or pencil (one per student)

5. Instructional Procedures

Steps: This standard was broken up into a number of steps and utilized multiple examples. Leading up to this lesson, students completed the following:

- 4/5: Students completed the in-class gizmo assignment involving the peppered moth.
(Introduction to HS-LS4-4 standard)
- 4/6: Students looked at camouflage as a favorable trait found in various animal species.
(Specifically: octopi and chameleons)
- 4/9: Students watched the video on pocket rock mice and took the online quiz as a class.
(Students introduced to gene variations)
- 4/10: Students took guided notes on Natural Selection and identified key elements.
(Students learn the components of natural selection and vocabulary)
- **4/11 (This lesson):** Students define ecomorph and collect data on various *Anolis* lizards using the hhmi virtual lab. *Anolis* traits are an example of natural selection and adaptation. Students will further their understanding of these two concepts by comparing the different trait found on the same genus of lizard within similar environmental niches.

Management issues:

Three transitions:

1. The first will fall between the warm-up question and the virtual lab. Students will share their answers to the warm-up question.
2. The second will take place between the virtual lab and the handout. Students will answer the question on the Lizard Evolution Virtual Lab worksheet.
3. The third will take place between the Lizard Evolution Virtual Lab worksheet and the exit ticket. The class will go over the answers to the worksheet.

Material location:

- Students will receive the worksheet while entering the class.
- Student laptops are in the laptop locker. (Students know to grab these when entering the room every day.)
- The laminated handout with names and photos of all 8 lizards will be on the students' desk prior to the start of class. (2 per table)
- Students have the natural selection notes.

Activity structure:

- Students will work with their table partners to complete the lab and associated handout.
- Student work groups are already established.
- At each step of the virtual lab, I will first demonstrate what is expected. Students will then be given time to complete the task on their own but will be monitored closely to make sure every step of the lab has been completed prior to moving on.

Technology Use:

- Students will use the class set of laptops to complete the warm-up question and the virtual lab.

Student Learning:

Learning style accommodations:

- Videos provided at each step of the lab will help visual and auditory learners.
- The mechanical completion of each step of the lab will help tactile learner.
- Verbal instructions will further help auditory learners.
- Physical demonstration of each step will further help visual and tactile learners.

A. Introduction (4-6 min)

- Students arrive and watch the following video: <https://youtu.be/M3bROOvWMcM>
- Students answer the following question:

What is one physical characteristic (from the video) that helped Lithipodius nulla (the little rock animal) survive?

- Once complete, students will share their answers to the warm-up question.
- The class will then engage in a teacher led discussion about these different traits.
- Students will be reminded that in order to be considered “successful” animals must survive and reproduce.

B. Activities or Learning Experiences (30-35 min)

- Students will open the *Lizard Evolution Virtual Lab* found on hhmi.org. (A link was provided on google classroom) (1 min)
- Students will follow along as I read the introduction to the lab. (1 min)

“The more than 700 islands of the Caribbean are home to about 150 species of anoles, a group of lizards of the genus Anolis. These lizards live in diverse habitats and vary greatly in size and other physical characteristics, such as leg and tail length and skin color and pattern.

Why are there so many species of anoles? And how did they evolve?

To answer these questions, you will perform several exercises modeled after actual research studies. The lab is divided into four modules, each one involving data collection, calculations, analysis, and answering questions. You can do just one or all four modules in their entirety, or parts of each.”

- Student will then click on Module 1: Ecomorphs.
<http://www.hhmi.org/biointeractive/lizard-evolution-virtual-lab>
 - Step 1: Students will group the 8 *Anolis* lizards by the way they look and will label the groups accordingly. (2 min)
 - Step 2: Students will measure the hind legs, body and tails lengths of 6 Anole lizards and count the toe pads of the other two. (8-10 min)
 - Step 3: Students will calculate the relative hind leg to body and tail to body lengths by dividing the tail or hind leg length by the body length. (3-4 min)
 - Step 4: Students will watch the 2 min video discussing the different *Anolis* habitats. (2 min)
 - Step 5: Students will consider regrouping their lizards. (1 min)
 - Step 6: Students will graph either the hind leg v. tail length or the toe pad number v. hind leg length to determine the classification of each Anole species. (5 min)

- Students will answer the first page of the Lizard Evolution Virtual Lab handout. (10 min)

C. Closure (5-10 min)

- Students will share their answers to the Lizard Evolution Virtual Lab handout in a teacher led discussion. (3-5 min)
- Students will answer the following question on an exit ticket: (1-2 min)

Please explain one way natural selection leads to adaptation of a species and provide one example from today's lab or the warm-up video.

D. Extension/ Contingency Plan

- Should time remain after the lesson:
 - Students will complete the seven-question quiz located at the end of module one of the virtual lab.
 - Students may move on to the second module.
- If this lesson goes poorly, the following video will be used as a contingency plan:
<https://youtu.be/aDIQFQOCGaI>
 - Students will write a C.E.R. (claim, evidence and reasoning) statement on why the salamanders of California have adapted to look so differently.
- If there is not enough time to complete the assignment:
 - Students will be given additional time to work on the virtual lab during class on 4/12/2018.

6. Accommodations/Modifications

- Digital copies of the handout will be provided, and students will be permitted to record the information covered in today's lesson in any format they prefer. Instruction for the lesson is given verbally and in writing.
- ELL students may use translation technology to help students better articulate and understand the various definitions covered in the lesson.
- If necessary, students may work in alternative groups; however, students must demonstrate a viable reason for this change.
- When specified, students with an IEP and/or 504 plan will be given additional time to complete this assignment.
- Examples are provided at each step of the virtual lab.

7. Assessment/Evaluation of Learning

Formative:

- Students will answer and submit the Lizard Evolution Virtual Lab handout.
- Students will submit and exit ticket prior to leaving the classroom.
- Students will provide verbal answers to in class questions.

Summative:

- Students will take an exam at the end of the following week. This exam will cover this material and the rest of the material covered in this unit.

8. Homework Assignment

- Students will complete the Lizard Evolution handout, if it was not finished in class.
- Students will study their notes in preparation for the exam.

9. CAL/ DL Connection and fieldtrip connection:

- This lesson is considered DL since it relies heavily on skills required only for science. Specifically, the collecting of data (aka evidence), the graphing of that data and the ability to draw conclusions using the data.
- My connection to the fieldtrip has to do with “survival of the fittest.” Just as Tara had to adapt to various obstacles to “survive,” so too do animals.

LIZARD EVOLUTION VIRTUAL LAB

Answer the following questions as you finish each module of the virtual lab.

Module 1: Ecomorphs

1. At the beginning of the virtual lab, you were asked to sort eight lizards into categories. What criteria did you initially use to make your groups? Did you revise your criteria later? Why?

2. An adaptation is a structure or function that is common in a population because it enhances the ability to survive and reproduce in a particular environment. Provide one example and an explanation of one adaptation in the *Anolis* lizards.

3. Provide one evolutionary explanation for why lizards living in the same part of the habitat (i.e., grass) would have similar characteristics.

4. What is an ecomorph? Provide one example from the virtual lab.

5. How is an ecomorph different from a species?

6. Explain how a particular body feature of one of the lizard ecomorphs from the virtual lab is an adaptation to their particular niche.

Author Bios

Chyllis E. Scott, Ph.D., works as an Associate Professor and Program Coordinator for Literacy Education in the Department of Teaching & Learning at the University of Nevada, Las Vegas. Her research focuses on content-area and disciplinary literacy, academic writing, and mentoring practices for pre-service and in-service teachers and students in higher education. Specifically, in the context of literacy instruction, she examines teacher knowledge and practices for pre-service and in-service teachers.

Matthew Albert, Ph.D., recently defended his dissertation titled: *Voices from the desks: Reconceptualizing the mentoring of beginning teachers* and earned his Ph.D. in Literacy Education in the Department of Teaching & Learning at the University of Nevada, Las Vegas - Spring 2023. He is currently a 6th grade English language arts teacher at The Meadows School in Las Vegas. His research focuses on teacher mentoring and beginning teacher induction.

Dian M. Miller, Ph.D., works as an Associate Professor of Literacy Education at the University of Houston-Downtown. To support her university teaching and diverse service, Dr. Miller's collaborative scholarly work is devoted to content-area/disciplinary literacy and mentoring. She serves as the Assistant Department Chair for Graduate Students in the Department of Urban Education, where she supports the development of new programs, primarily the educational leadership initiative.

Franklin S. Allaire, Ph.D., is an Assistant Professor of Science Education in the Department of Urban Education at the University of Houston-Downtown where he teaches undergraduate and graduate courses in elementary and secondary science methods. His research interests focus on issues impacting the success of underrepresented minorities in STEM-related fields and the innovative use of technologies and pedagogies in the professional development of science teachers and teacher candidates.

Katlyn Cox, Ph.D., works as an instructor at College of Southern Nevada as an instructor in the Mathematics Department. Her research focuses on mathematics instruction at the post-secondary level, with specific interest in how instructors' beliefs impact their classroom practices. The aim of this research is to understand why instructors choose to apply certain teaching practices in classrooms at a collegiate level and how these college instructors might be supported and encouraged to implement research-based and student-centered teaching practices.