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Dialogic inquiry into problem-based learning in environmental education: A Ghanaian preservice teacher's perspective

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ABSTRACT

Despite increasing global attention to learner-centered approaches in environmental education (EE), there is limited research on how preservice teachers in Ghana make sense of problem-based learning (PBL), particularly through the lens of their lived experiences and sociocultural contexts. This study addresses that gap by exploring how one Ghanaian preservice teacher constructs his understanding of PBL and environmental education using Bakhtin's concepts of *Ventriloquism* and *Voice*. Through a dialogic analysis of a semi-structured interview, the study uncovers the multiple voices; personal, institutional, and environmental, that shape his evolving teacher identity and pedagogical vision. The findings reveal how narrative becomes a site for negotiating meaning, expressing professional intentions, and imagining education as a vehicle for environmental and social transformation. This research contributes to a growing body of work using dialogic and narrative frameworks to examine teacher development and highlights the need for more contextually grounded studies in EE and PBL within Ghana's teacher education system.

Keywords: environmental education, problem-based learning, voice and ventriloquism, preservice teachers

INTRODUCTION

Despite growing global advocacy for learner-centered pedagogies in Environmental Education (EE), limited research exists on how preservice teachers in Ghana make sense of problem-based learning (PBL) as an instructional approach, particularly through the lens of their lived experiences, cultural contexts, and emerging teaching identities. This study addresses this gap by exploring how one preservice teacher narrates his understanding of PBL in relation to environmental science education, using Bakhtin's concepts of *Ventriloquism* and *Voice* as an interpretive framework.

Environmental Education (EE), also known as Education for Sustainability (EfS), Education for Sustainable Development (ESD), and Environmental and Sustainability Education (ESE), seeks to prepare environmentally

literate citizens capable of addressing the interconnected challenges of environmental conservation, economic development, and social justice. While these terms differ in emphasis (Gkiolmas & Skordoulis, 2020), they share a core commitment to empowering learners to engage with complex sustainability issues. EE aims not only to build knowledge but also to cultivate the values, skills, and agency necessary for individuals to participate meaningfully in environmental problem-solving at local and global levels. Since the 1992 United Nations Conference on Environment and Development, education has been recognized as pivotal to achieving sustainability goals, especially when curricula incorporate themes such as climate change, biodiversity, poverty, and responsible consumption (UNESCO, 2015, 2017).

The Belgrade Charter (UNESCO, 1975) and the Tbilisi Declaration (UNESCO, 1978) further emphasize the need for pedagogies that are participatory, action-oriented, and learner-centered, pedagogies that develop critical thinking and a sense of responsibility for the natural world. Among such approaches, PBL stands out for its emphasis on real-world problem-solving, collaboration, and inquiry. In the context of EE, PBL supports deeper engagement with environmental science concepts by mirroring the interdisciplinary and often ambiguous nature of sustainability issues. Moreover, it promotes essential 21st-century skills such as systems thinking, civic engagement, and self-directed learning (Ardoin et al., 2022; Hmelo-Silver, 2004; Loyens et al., 2008).

However, understanding how preservice teachers engage with PBL requires more than a surface assessment of their preferences or pedagogical choices. Teaching is shaped by one's identity, past experiences, institutional norms, and cultural narratives. To examine these complexities, this study draws on Mikhail Bakhtin's concepts of *Ventriloquism* and *Voice*, adapted in educational research by Alberto J. Rodríguez (Rodríguez, 2000) and more extensively in the field of communication studies by François Cooren (Cooren, 2012, 2016; Cooren & Sandler, 2014). These theoretical tools allow us to analyze how teachers' stories reflect multiple, sometimes competing voices—from their own lived experiences to the expectations of schooling systems, community values, and broader discourses about science and education.

Ventriloquism, in this context, refers to the way individuals speak not only with their own voice but also through the voices of others—be they mentors, cultural figures, institutional logics, or prior classroom experiences. Similarly, *Voice* refers to the ideological and social positioning embedded in language, tone, and storytelling. This framework allows researchers to view preservice teachers not simply as knowledge holders or pedagogical agents, but as narrators navigating multiple identities, reenacting and reconstructing their understanding of teaching through the interplay of self and non-self (Bakhtin, 1981; Kearney, 1984).

Thus, rather than asking only what preservice teachers think about PBL, this study explores how they narrate their relationship to it, what voices and experiences are ventriloquized in their stories, and what these stories reveal about their emerging identities as educators. The study focuses on Wisdom, a preservice teacher in Ghana, and his narrative reflections on PBL and environmental science instruction.

The purpose of this qualitative case study is to explore how one Ghanaian preservice elementary teacher, Wisdom, constructs and communicates his understanding of PBL in relation to environmental science education. Using Bakhtin's concepts of *Ventriloquism* and *Voice* as an interpretive lens, the study seeks to uncover the polyphonic dimensions of Wisdom's narrative, how various voices (cultural, institutional, personal) interact in shaping his views and intentions as a future educator. Specifically, the study addresses the following questions:

RQ1: How do preservice teachers perform and negotiate their understandings of PBL through the polyphony of voices embedded in their narratives?

RQ2: What ventriloquized voices emerge in preservice teachers' stories about using PBL to teach environmental science, and how do these voices reflect their educational identities, social contexts, and ideological intentions?

RQ3: How do preservice teachers use ventriloquized voices to express agency and envision transformative possibilities for teaching and community engagement through PBL?

Understanding how preservice teachers narrate their pedagogical identities and choices, especially through storytelling frameworks that surface polyphony, can yield powerful insights for teacher education in general and environmental education in particular. In Ghana, where national teaching frameworks and standards promote inquiry-based teaching (National Council for Curriculum and Assessment [NaCCA], 2019; Transforming Teaching, Education & Learning [T-TEL], 2016, 2019), little is known about how such reforms are internalized and interpreted by preservice teachers. This study not only contributes to that knowledge gap but also demonstrates how narrative inquiry, grounded in Bakhtinian theory, can help researchers uncover the deeper motivations, constraints, and aspirations shaping the next generation of science educators.

LITERATURE REVIEW

PBL originated in the 1960s at McMaster University's medical school in Canada as an innovative approach to developing critical thinking and problem-solving skills among medical students (Barrows & Tamblyn, 1980). Since then, PBL has been widely adopted across various disciplines, including teacher education, as a pedagogical strategy that fosters deep learning through inquiry and real-world problem engagement (Hmelo-Silver, 2004). In preservice teacher education, PBL has gained recognition as an effective instructional approach, particularly in preparing educators to teach about the environment (Torp & Sage, 2002). By emphasizing active, student-centered learning, PBL immerses students in authentic real-world problems, enabling them to develop problem-solving skills, engage in collaborative inquiry, and integrate theoretical knowledge with practical application (Ertmer & Simons, 2006). The experiential nature of PBL aligns well with the goals of EE, equipping future teachers with the skills and dispositions necessary to foster sustainability literacy in their students.

The grave environmental issues in Ghana, such as deforestation, climate change, and waste management (Acheampong et al., 2019; Tahiru et al., 2024; World Bank Group, 2022), make it important to examine the PCKs employed in teaching environmental science concepts if strides are to be made toward sustainability. However, despite its potential, scholarly research on PBL implementation in the Ghanaian educational sector is scanty and limited to only a few mentions in medical education (Alhassan & Majeed, 2018; Amoako-Sakyi & Amonoo-Kuofi, 2015; Mogre et al., 2014), higher education (Bentil, 2018; Lamptey et al., 2019) and mathematics education in preservice teacher education (Boye, 2019, 2020; Boye & Agyei, 2023; Ibrahim & Asiedu-Addo, 2019). A close review of the available literature reveals that no studies have been reported on the use of PBL in the teaching and learning of environmental concepts in Ghana neither does scholarly data exists about the assessment of the awareness or perceptions of preservice teachers about PBL.

Environmental Education in the Ghanaian Context

In Ghana, environmental education is integrated into the elementary school science and social studies curricula. This inclusion was informed by several recommendations including the Ghana Education Review Committee Report (Ghana Ministry of Education [GMoE], 2007) and the United Nations Sustainable Development Goal (SDG) 13.3 on climate action.

The United Nations Sustainable Development Goal 13.3 aims to improve education, raise awareness, build human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning (UN DESA, 2015). Therefore, Ghana's newly implemented Standards Based Curriculum (SBC) for K-6, launched in 2019, includes specific sections within the primary (grades 1–6; ages 7–12 years) science and social studies curriculum dedicated to sustainability education (**Table 1**). The primary (Basic 1–6) science curriculum dedicates a strand to *Humans and the Environment* under which *Climate Change* and *Personal Hygiene and Sanitation* are explicitly outlined (NaCCA, 2019).

Table 1. Structure and scope of Ghanaian standards based curriculum (SBC) for elementary science

Strand	B1 Sub-strands	B2 Sub-strands	B3 Sub-strands	B4 Sub-strands	B5 Sub-strands	B6 Sub-strands
Diversity of matter	Living and non-living things	Living and non-living things	Living and non-living things	Living and non-living things	Living and non-living things	Living and non-living things
	Materials	Materials	Materials	Materials	Materials	Materials
Cycles	Earth science	Earth science	Earth science	Earth science	Earth science	Earth science
	Life cycles of organisms		Life cycles of organisms	Life cycles of organisms	Life cycles of organisms	Life cycles of organisms
Systems	The human body systems	The human body systems	The human body systems	The human body systems	The human body systems	The human body systems
	Ecosystems	The solar system	The solar system	The solar system	The solar system	The solar system
			Ecosystems	Ecosystems	Ecosystems	Ecosystems
Forces and energy	Sources and forms of energy	Sources and forms of energy	Sources and forms of energy	Sources and forms of energy	Sources and forms of energy	Sources and forms of energy
	Electricity and electronics	Electricity and electronics	Electricity and electronics	Electricity and electronics	Electricity and electronics	Electricity and electronics
	Forces and movement	Forces and movement	Forces and movement	Forces and movement	Forces and movement	Forces and movement
Humans and the environment	Personal hygiene and sanitation	Personal hygiene and sanitation	Personal hygiene and sanitation	Personal hygiene and sanitation	Personal hygiene and sanitation	Personal hygiene and sanitation
	Diseases	Diseases	Diseases	Diseases	Diseases	Diseases
	Science and industry	Science and industry	Science and industry	Climate change	Science and industry	Science and industry
	Climate change	Climate change	Climate change		Climate change	Climate change

Adapted from National Council of Curriculum and Assessment (NaCCA), Ministry of Education, 2019. B1-B6 correspond to elementary school grades 1-6.

Moreover, beyond the goal of achieving SDG 13.3, the rapid degradation of Ghana's environment and natural resources underscores the urgent need for environmental education to foster responsible stewardship, particularly among the next generation of citizens. Solid waste pollution, loss of biodiversity, deforestation, illegal small-scale mining (colloquially called *galamsey*) and its concomitant pollution of drinking water sources have been widely reported (Acheampong et al., 2019; Anoyege & Alatinga, 2024; Tahiru et al., 2024; World Bank Group, 2022). While some of these issues require political action, a well-implemented sustainability education can nurture a new generation with strong environmental values, a deep sense of responsibility, and the motivation to actively protect and improve the environment (UNESCO, 1978).

Environmental literacy and attitudes develop in children during their early years, with teachers serving as key facilitators of this education (Basile, 2000; Powers, 2004). Therefore, the key to nurturing environmentally literate students lies primarily in ensuring that elementary teachers possess the requisite knowledge, skills, and sense of responsibility to develop environmental lessons effectively. Teacher knowledge of content in a specific subject area as well as the accompanying content specific pedagogy, called Pedagogical Content Knowledge (PCK), is a mark of an effective teacher and an effective teacher education curriculum (Shulman, 1986). Pedagogical strategies in environmental education that have been noted for their significant impact on fostering students' curiosity and motivation to take action include experiential, community-based, and inquiry-based approaches (Sims et al., 2020). These strategies align closely with the principles of PBL, emphasizing hands-on experiences, engagement with local communities, and fostering inquiry skills.

The Role of PBL in EE

PBL is the learning that results from the process of working towards the understanding of a resolution of a problem. The problem is encountered first in the learning process (Barrows & Tamblyn, 1980). PBL as an

instructional approach emphasizes experiential learning (Dewey, 1938) and focuses on the process of how we learn in addition to the content that is learned. PBL has as its underlying assumption that learning occurs during the process of exploring, explaining, and solving real-life problems with unclear solutions (Barrows, 2000; Torp & Sage, 2002). The principal idea behind PBL is that the starting point for learning should be a problem, a query, or a puzzle that the learner wishes to solve (Hillman, 2003). In this way, PBL leverages students' natural curiosity and motivation. The strength of PBL as an instructional model lies in its ability to improve students' intrinsic motivation and engagement; prepare students to solve real-life challenges; facilitate long-term retention of content; promote critical thinking; foster self-directed learning, problem-solving, and higher-order reasoning; enhance collaboration and communication skills (Baden & Major, 2004; Barrows, 1996; Hmelo-Silver, 2004; Jonassen & Hung, 2015; Schmidt et al., 2011, 2019; Vernon & Blake, 1993). PBL scenarios, like environmental issues, are often interdisciplinary, and require students to draw on knowledge from various fields to solve problems effectively. This way, PBL encourages students to make connections between different subjects and apply their knowledge in a holistic manner.

Studies across educational levels demonstrate the effectiveness of PBL in advancing EE outcomes. At the elementary level, research by Febriasari and Supriatna (2017) and Arisanti et al. (2022) highlights significant improvements in students' environmental knowledge, attitudes, and behaviors. In secondary education, PBL has been linked to the development of higher-order thinking skills and increased pro-environmental actions, as observed by Amin et al. (2020). Within preservice teacher education, studies by Kuvac and Koc (2018), Vasconcelos (2010), and Heystek (2021) report enhanced pedagogical reasoning, content understanding, and a deeper commitment to environmental responsibility, demonstrating PBL's potential to prepare educators as both facilitators and role models of sustainability.

PBL in Ghanaian Educational Contexts

Although PBL has seen considerable implementation in K-12 education since its inception in the 1960s, it remains a largely recent and unknown instructional model in Ghana. Scholarly research on PBL implementation in the Ghanaian educational sector is scanty and limited to only a few mentions in medical education (Alhassan & Majeed, 2018; Amoako-Sakyi & Amonoo-Kuofi, 2015; Mogre et al., 2014), higher education (Bentil, 2018; Lamptey et al., 2019) and mathematics education in preservice teacher education (Boye, 2019, 2020; Boye & Agyei, 2023; Ibrahim & Asiedu-Addo, 2019). A close review of the existing literature reveals that only no study has examined the use of PBL in teaching environmental concepts in Ghana. Moreover, there is a lack of scholarly data assessing preservice teachers' awareness, sense-making, and perceptions of PBL in this context.

Even though there is limited research on the implementation of PBL in Ghana's educational system, curriculum developers for the country's basic education (K-12) and teacher education advocate for active learner-centered pedagogies, including PBL, for teaching science concepts. For instance, the four-year Bachelor of Education Course manual on Environmental Biology specifies that fundamental science concepts such as ecosystems and the classification of plants and animals should be taught "using appropriate pedagogies such as nature walks, talk-for-learning approaches, demonstrations, concept mapping, and problem-based teaching/learning" (T-TEL, 2021, p. 10). PBL is incorporated into the science pedagogy curriculum for preservice teachers as an example of inquiry-based pedagogy and featured in professional development manuals for tutors at colleges of education. Exploring how preservice teachers narrate and make meaning of their PBL experiences in colleges of education can reveal the multiple voices shaping their emerging teaching identities and illuminate their potential readiness to engage with PBL as a transformative instructional model in their future practice.

METHODOLOGY

This basic qualitative study adopts an interpretive design grounded in Bakhtin's concepts of *Ventriloquism* and *Voice* to explore how preservice elementary teachers in Ghana construct meaning from their experiences with PBL. Rather than simply documenting perceptions, the study focuses on the polyphonic narratives of one participant. Wisdom, to examine how multiple voices and situated experiences shape his understanding of PBL and its role in environmental science education. Drawing from phenomenological traditions (Merriam & Tisdell, 2016), this approach emphasizes process, meaning-making, and the situated nature of knowledge. It aligns with the study's central aim: to interpret how preservice teachers, through storytelling, express their pedagogical identities, enact ventriloquized voices, and imagine themselves as future educators promoting environmental stewardship through PBL.

Context of the Study

The study was conducted at Birim College of Education, one of 46 public teacher training colleges in Ghana, now functioning as a degree-awarding institution under the mentorship of the University of Cape Coast. The college has a strong track record in STEM teacher preparation and was selected through snowball sampling, following a recommendation by a tutor from another institution. Using purposeful sampling (Patton, 2015), five third-year students enrolled in the Bachelor of Education in Primary Education program were initially recruited. Participants had to meet the following inclusion criteria:

1. be an active student at Birim College of Education,
2. be enrolled in the B.Ed. Primary Education program,
3. have completed a science methods coursework.

After institutional consent was secured through the Head of the Science Department, participant recruitment proceeded voluntarily via an email invitation. Consent forms were distributed through WhatsApp, and all participants chose pseudonyms to ensure confidentiality. Additionally, a pseudonym is used to protect the identity of the college of education.

Data Collection and Ethical Considerations

Semi-structured interviews were conducted via Zoom and lasted between 45 to 60 minutes. The interview protocol (**Appendix A**), designed purposely for this study, included open-ended questions on participants' educational background, PBL experiences, and perspectives on using PBL to teach environmental science. Flexibility in question order and phrasing allowed for the emergence of participants' authentic narratives and dialogic responses (Merriam & Tisdell, 2016). Participants were not required to disclose sensitive information and were free to skip any questions. All data were securely stored, and pseudonyms were used throughout transcription and analysis.

Participant Selection

Although five interviews were conducted, Wisdom's case was selected for this manuscript because of its rich, layered, and dialogically complex nature. His storytelling revealed multiple intersecting voices—those of former teachers, cultural norms, institutional constraints, and personal hopes for community transformation. As such, Wisdom's case serves as a compelling scenario for exploring Bakhtin's notion of *ventriloquized voices*, where the self is shaped in conversation with others. Wisdom's account provided deep insights into how preservice teachers reimagine teaching as a socially transformative practice, making it well-suited for the goals of this study.

Data Analysis

The interview transcript was processed using MAXQDA software to explore two focal themes: the participating preservice teacher's past and current educational experiences (the self), and his views on mitigating environmental issues (the other), both of which are informed by cultural factors, personal goals, and aspirations. The data processing followed a systematic approach to ensure the accuracy and depth of the narrative developed. contains the coding system applied in the analysis of the interview transcript.

Narrative Construction

The construction of a narrative summarizing the main themes that surfaced in the analysis of the interview transcript using MXQDA involved systematically organizing the coded data into coherent categories. By applying thematic codes such as environmental education, local culture, aspirations, and environmental degradation, key insights emerged regarding the preservice teacher's views on the environment. MXQDA's tools allowed for the identification of recurring patterns, such as how the teacher's family and social norms influenced their understanding of local environmental issues. These themes were then woven into a narrative that captured the teacher's perspective on the environmental quality of their region, their aspirations for future environmental education, and how personal and cultural factors shaped their views. This narrative provides a comprehensive overview of the teacher's experiences and beliefs, highlighting the intersection of personal, societal, and environmental influences.

Wisdom's narrative (**Appendix B**) was constructed with the aim of providing a comprehensive account of the participant's educational experiences, including significant milestones, challenges, and motivations that shaped his journey toward becoming an elementary school teacher interested in meaningful educational experiences for his own students and future citizens in his country. Additionally, the narrative highlights the participant's attitudes toward environmental issues, detailing their personal commitment to sustainability and how he envisions addressing environmental concerns within their future classrooms. To ensure the accuracy and authenticity of the narrative, the narrative draft was subject to a process of member checking. Wisdom was provided with a copy of his narrative and asked to review it for clarity, accuracy, and representation of his views. Wisdom was encouraged to provide feedback on the narrative, identify any discrepancies or misinterpretations, and suggest additions or revisions. This process allowed for a collaborative refinement of the narrative, ensuring that the final version reflected his voice and perspectives in a true and meaningful way. After incorporating the feedback from member checking, the narrative was finalized. The final version of the narrative accurately reflected the participant's educational path and environmental outlook, capturing both their personal and professional aspirations. Wisdom's narrative serves as a rich and detailed account that not only provides insights into his educational journey but also highlights how environmental issues intersect with his evolving identity as a preservice elementary teacher.

RESULTS

The interview transcript was processed to explore two focal themes: the participating preservice teacher's past and current educational experiences (the self), and his views on mitigating environmental issues (the other), both of which are informed by cultural factors, personal goals, and aspirations. The data processing followed a systematic approach to ensure the accuracy and depth of the narrative developed. The coding system (**Table 2**) applied in the analysis of the interview transcript included the following parent codes:

(a) The self**,**
(b) Culture/social norms,
(c) Relationship with the natural environment,
(d) Environmental education.

Table 2. Qualitative code system

Parent code	Code examples	Coded segment examples	Segments & percentage
1. The self	Occupation; career goals	No, I still choose teaching because right now entering into college, I've just realized that teaching is one of the best professions that someone could take care of.	58 (38.67%)
2. Culture/social norms	Interactions with others in the community	If I had the courage and boldness at that time, I could have told him that, no, that I won't be in teaching or something. But at that age, I wasn't able to say that.	42 (28.00%)
3. Relationship with the natural environment	Awareness of environmental issues	They use it as a source of drinking water. Yeah. The food sellers, they use it to cook. They go to fetch water from the lake and used to cook. Yeah.	34 (22.67%)
4. Environmental education	Teaching style, teaching goals	So, about the tree cutting, when we try to plant trees, I think it should help. And also, when we try to educate people about it, because most people don't know that this is what they are doing.	16 (10.67%)
TOTAL			150 (100%)

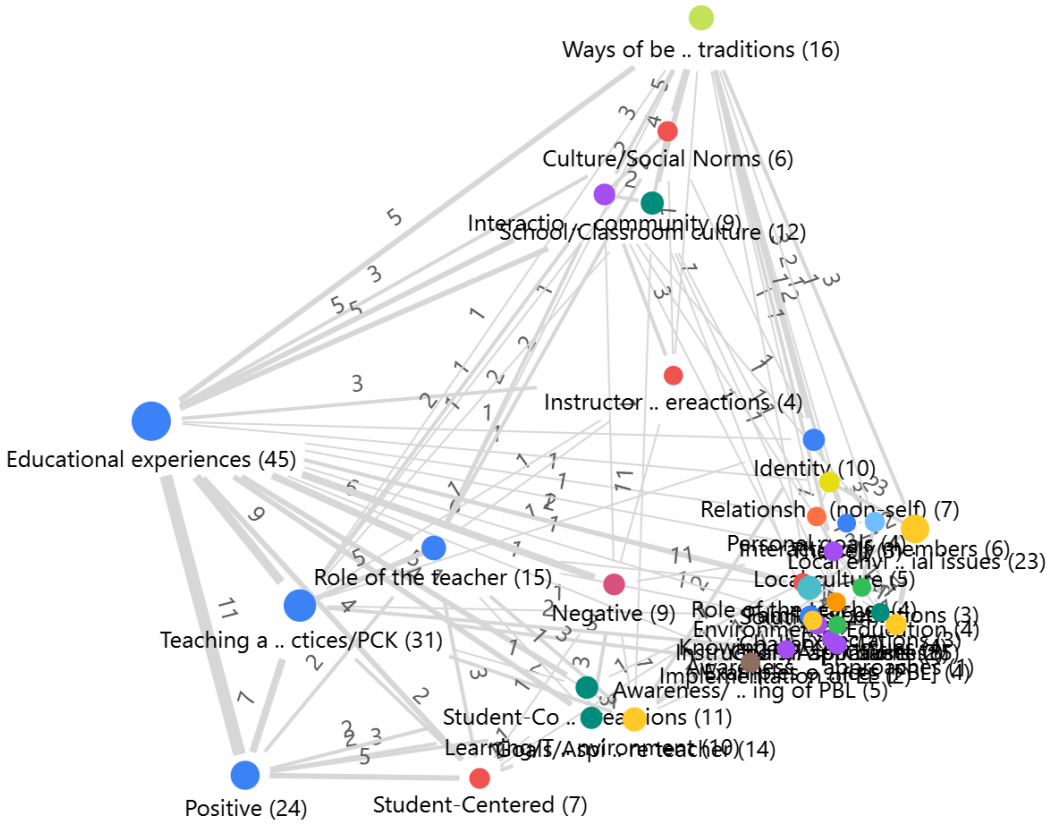

Figure 1. Code map illustrating emerging themes derived from the interview transcript

The standpoints expressed by Wisdom in his interview with the researcher were mostly associated with his views about his education, both in high school and college, and about what he considers pressing environmental issues in his community; his views were supported by the characteristics of the socio-cultural contexts identified in his recollections of his life as a student, son, and member of the community. Correspondingly, these stances surfaced in the processing of the interview transcript that employed the MAXQDA software. The code map in **Figure 1** shows two strong relationships with culture, which may be seen as the issues that matter to Wisdom: first, *Educational Experiences and Ways of Being (Culture), and second, Relationships with the Natural Environment and Ways of Being (Culture)*.

Four interrelated themes emerged from the analysis of Wisdom's narrative, illustrating how his experiences, beliefs, and pedagogical aspirations are shaped through a multiplicity of voices and lived experiences. These findings illuminate how Wisdom makes sense of PBL and its role in environmental science education.

Personal Experience and Teacher Identity Formation

Wisdom's narrative foregrounds the influence of personal and community experiences on his decision to become a teacher. Recalling a mix of supportive and harmful schooling experiences, he ventriloquizes the voices of past teachers and community norms in constructing his teaching identity. The harsh discipline of his physics teacher, embodied in the use of a cane, contrasts sharply with the humor and engagement of his biology teacher.

These contrasting voices shape his vision of effective teaching and reinforce his desire to create a classroom that is respectful, student-centered, and empowering. His story reflects an intentional break from authoritarian models of instruction, favoring instead a pedagogy that nurtures confidence and curiosity.

Learning Through *Voice*: Engagement, Impact, and Meaning

Wisdom speaks through the voices of past mentors and his own learning encounters to highlight how different instructional styles shaped his academic growth and personal development. Lab-based lessons in chemistry and independent investigations in English classes were described with excitement, illustrating how hands-on and inquiry-based experiences made learning meaningful. These experiences now inform his aspirations to cultivate similar environments for his future students; spaces that are dialogic rather than rigid, and which promote expressive, socially conscious learners. Through these accounts, Wisdom positions himself as a future educator capable of fostering not only knowledge but also voice, agency, and civic engagement.

Approaches to Teaching: Embracing and Reimagining PBL

In reflecting on his training in teaching methodologies, Wisdom recalls exposure to various strategies, including lecture, simulation, discussion, and PBL. He expresses a clear preference for hands-on learning and PBL due to their active and practical nature. However, his account reveals a form of *ventriloquized PBL*, an approach he experienced as active learning that promoted student agency, though it lacked the structural features of authentic PBL. Wisdom's narrative reflects both enthusiasm and caution: while he anticipates using PBL to teach environmental science, he is aware of implementation challenges in under-resourced schools. He recognizes the need for further training to fully integrate PBL yet remains committed to using it as a means to engage students in real-world, locally relevant problem-solving.

Education as a Tool for Environmental and Social Transformation

Wisdom draws on personal, familial, and community voices to position education as a transformative force in addressing pressing societal issues. He identifies challenges such as teenage pregnancy, poor sanitation, water pollution, and climate change, noting how these affect his community and family. His narrative links education to activism: by empowering students with environmental and social awareness, he believes teachers can foster change within households and communities. Referencing experiences from high school and family farming, he shares how erratic rainfall, a climate change impact, has disrupted corn production in his community including his father's farm, reinforcing his belief that education can shape environmentally responsible citizens. His reflections convey a clear intentionality: to teach in ways that equip students to not only understand problems, but to become agents of local and global solutions.

DISCUSSION

This study explored how Wisdom, a Ghanaian preservice teacher, constructed his understanding of PBL and environmental education through narrative, using Bakhtin's concepts of *Ventriloquism* and *Voice* (Bakhtin, 1981; Cooren, 2012). Bakhtin's concept of *Voice* refers to the distinct social perspectives and ideological positions that are carried in language, while v*entriloquism* refers to the way speakers *animate or speak through* other voices, whether those of institutions, traditions, or imagined others. Through this dialogic lens, Wisdom's interview reveals not only his educational experiences and teaching aspirations but also the polyphonic interplay of voices that shape his thinking, identity, and intentions. In this analysis, Wisdom is the ventriloquist, and the multiple voices he draws on reflect both his internalized understanding of the world and his intentionality as a preservice teacher trying to make sense of his role in addressing environmental issues. Wisdom's storytelling is shaped by the voices of past teachers, family, institutional expectations, and community realities. In recounting his educational journey, he animates figures such as the harsh physics teacher and the engaging biology teacher, each representing competing models of instruction. These ventriloquized voices highlight the tension between authoritarian and student-centered pedagogies, which Wisdom seeks to resolve in his future classroom. His preferences for hands-on learning and PBL are not expressed as isolated opinions but as responses to lived experiences, through which he has come to value active, inquiry-based methods (Hmelo-Silver, 2004; Loyens et al., 2008). This addresses the first research question by showing how Wisdom negotiates his understanding of PBL through the layered voices in his narrative, including past instructional models and his own reflections on what meaningful learning entails.

In his work, Rodríguez (2000) argues that the significance of this approach in science education lies in its versatility as a tool to explore ways of supporting the participation of traditionally disenfranchised student groups in STEM education. In line with this perspective, the present discussion interprets Wisdom's narrative using the concepts of *Voice* and *Ventriloquism*, focusing on the reconstruction of the self in the context of his social and educational environment. In this study, the concepts of Self and Non-self follow Kearney's (1984) *Worldview Universals*, which include Classification, Relationship, Causality, Time, and Space, elements that shape how individuals understand and navigate reality. Within this epistemological framework, ventriloquism becomes a powerful tool to uncover the often-hidden perspectives and ideologies embedded in student narratives.

In describing his PBL experience, Wisdom does not portray it as fully formed or formally structured, but rather as an approach that promoted student agency and engagement. His narrative reveals a partial implementation of PBL, yet he imbues it with potential, ventriloquizing the ideals of learner independence and real-world relevance. At the same time, his awareness of the resource constraints in public schools adds a critical voice to this discourse, expressing both optimism and caution about pedagogical reform (Nicholas & Scribner, 2021).

The act of storytelling inherently involves entertainment and meaning-making. Drawing from oral traditions in many cultures, where elders pass down knowledge about medicine, religion, or history, storytelling creates resonance between the teller and the listener. As Rodríguez (2000) reminds us, "there is a danger in allowing ourselves to be swept by the teller's captivating narratives without asking what are the teller's motives or intentionality" (p. 14). The motives and intentionality of the storyteller reveal the ideological, political, and pedagogical meanings of their self-representation. In Wisdom's case, his narrative choices (what he shares, emphasizes, and omits) invite an inquiry into both his worldview and his vision of himself as a future educator.

This section illustrates how ventriloquized voices are present in Wisdom's storytelling and how he, as the ventriloquist, constructs a dialogic narrative filled with intention and layered meanings. As Cooren and Sandler (2014) point out, "the world we live in is a speaking and personified world; a world that comes to speak through us because people make it speak in a specific way" (p. 225). *Ventriloquism*, in this context, refers to our capacity to animate other perspectives (people, institutions, social discourses, even natural elements) as we

speak or write. Wisdom's discussion of environmental issues in his community further illustrates the layered nature of voice. His recounting of poor housing conditions, inadequate sanitation, and lake pollution gives voice to often-overlooked material realities that "speak" through their effects on daily life. These environments are not just described; they are personified and made to speak through Wisdom's narrative, showing how the nonhuman world participates in his meaning-making (Cooren & Sandler, 2014).

In the first excerpt below (Interview segment 44–56: Environmental issues in the community) and in response to the researcher's question, Wisdom discusses environmental issues in a nearby Yeji community, he ventriloquizes several voices. This segment responds to the second research question by identifying the ventriloquized voices of marginalized residents, the environment, and institutional neglect, that populate Wisdom's story. These voices reflect the broader social realities and values that shape his evolving educational identity.

(R: Researcher; W: Wisdom)

R: *Now I'm thinking about environmental issues in particular in our society. What are some of the environmental issues in the area where you live?*

W: *Environmental issues. Is it about environmental degradation, personal hygiene?*

R: *Things like that. So, I spoke with one, the person said in my area there's a lot of galamsey, so it degrades the land, exposed the water, things like that. What are some of those environmental issues in your area?*

W: *Environmental issues. Well, first of all, I was talking about like slums, like that issue that how they build their houses. I'm using Yeji as an example because though I don't stay there, I used to go there to visit some relatives nearby town, Yeji. And there is this area that is crowded. There is a settlement of the ewe. The ewe people reside there. How their buildings are just so close slums, there are no, like, I don't know how to say it.*

W: *So, I'm just talking about how they put up their houses. So, it's one of the environmental challenges. Like the buildings that they've put up, the way that they've put them up. There are no spaces in between and the buildings that they put up are so close to each other that you can't be passing through. Yes. So that's one of the issues. But then there is also an issue of, like, dirt and uncleanliness. Let me say that. Yes. Like waste management, those things. You know, Yeji, the place seems to be a waterlogged area. Because of the lake, when it rains, it easily floods some parts of the town. Yes. And the waste management is just so poor that they don't have dustbins. They have dustbins located at some places. They don't go there, but rather they just litter around anyhow. They don't have....how do you call these that you put dirt in. It's a recycle bin. Recycle bins too are not enough to help. So sometimes when it's raining, it just pour all these dirt into the rain so that it takes away. They go a long way, to enter into the lake . So, I think these are the environmental issues about cleanliness and how they manage their waste. Yeah.*

R: *The lake, do they use it as a source of drinking water or anything like that?*

W: *Yeah. They use it as a source of drinking water. Yeah. The food sellers, they use it to cook. They go to fetch water from the lake and used to cook. Yeah.*

R: *They go and fetch water from there. That's the water they used to cook. And all this trash is going into it.*

W: *Yes, ma'am.*

When describing slums and inadequate housing, he channels the voice of the marginalized community, particularly the Ewe residents he observed. He remarks, "the buildings that they've put up are so close to each other that you can't be passing through." Even though he does not live in Yeji, his description animates the lived

experience of others, creating an empathic portrayal of environmental neglect. He also gives voice to nonhuman agents (the rain, the lake, and the waste) depicting how environmental degradation is experienced materially. He explains, "when it rains, it just pours all this dirt into the rain... to go a long way, to enter into the lake." In describing how litter flows into the lake and later becomes drinking and cooking water, Wisdom gives the environment an active role in his story. This personification reflects a deep ecological awareness, even as he critiques the lack of infrastructure and the inadequate waste management systems. These voices, while not explicitly stated as his own, are ventriloquized through his narrative choices, word selection, and tone. He positions himself as a witness to structural inequalities and as a narrator who mediates between his personal experiences and broader community concerns. The intentionality behind this narrative, what he chooses to represent and how, reveals his emerging educational consciousness.

In the second excerpt below (Interview segment 57–62), Wisdom shifts from observation to aspiration, projecting himself into the role of a teacher committed to community change.

R: *The solution can come from up, like maybe politicians or some other kind of powerful person. But there are things that individuals can also do.*

W: *Yes, ma'am.*

R: *Like you mentioned earlier. Yeah. Thinking about environmental issues, do you think teachers and students have a role they can play?*

W: *Yeah. Teachers can play a key role in that.*

R: *What do you think they can do?*

W: *Because as teachers, you know, we have, let me say, the case that the students spend so much time with as teachers than they do with their parents. There are some cases that don't have the kind of relations that some teachers have with their children. I mean, their students is like when it comes to sharing of information and thoughts. It's stronger than how some parents even have with their children. So, talking about that, when we tried to teach them how to, like, proper waste management practices, we told them the effects it will have on them. I think that they can change things. You know, the children around here too, they turn up to believe in us teachers than their parents. Yeah. So, when you teach them these practices, when they go home, they can even influence their parents to do the right thing. So, when the kids know, they will tell their mothers and fathers that you teach, I say, ma'am. I have my siblings that used to tell me that sometimes when he comes home with homework, you try to teach him the right something. And he said that they were my teachers. I think that we teach them these things and how to manage some of these things. They can play a very key role. That is the students. When we engage the community, we can go to the chiefs and community leaders and talk to them about some issues. Let me say about proper waste management practices and talk to them about it. And even see if we can organize, let's say in a small community, we can organize the whole community and start to try to talk to them about this waste management practices and environmental, some environmental campaigns, something like that, so that they help. So we can play a very key role to help.*

When he asserts that students "spend more time with teachers than they do with their parents," he ventriloquizes the voice of educational influence, amplifying the transformative role of the teacher in students' lives. He positions students not merely as recipients of knowledge, but as agents of change who carry environmental values back into their homes. He explains, "when we teach them these practices... they go home and influence their parents to do the right thing." This example illustrates the third research question by showing how Wisdom uses ventriloquized voices to express agency and imagine transformative teaching, positioning students as civic actors and education as a catalyst for environmental and social change. Here, he

channels a student voice, one that believes, trusts, and imitates teachers, as part of a strategy to create ripple effects of learning beyond the classroom.

Importantly, Wisdom positions education (and himself as a future teacher) as a vehicle for social and environmental change. He assigns agency to students, imagining them as conveyors of environmental knowledge and change-makers within their families and communities. This imaginative move reflects his intention to prepare students not just as learners but as participants in civic and environmental transformation (Ardoin et al., 2022; UNESCO, 2017). Here, he ventriloquizes both future students and the institution of education itself, envisioning a collaborative response to environmental degradation.

When he imagines engaging local chiefs and organizing community clean-up campaigns, Wisdom ventriloquizes the voice of civic leadership, as well as the voice of a future self who sees teachers as community mobilizers. These ventriloquized voices: students, community leaders, family members, are all constructed dialogically within his narrative. They do not just reflect what *is*, but project what *could be*. This illustrates Bakhtin's concept of polyphony, where multiple social perspectives co-exist and interact within a single speaker's account.

Throughout the interview, Wisdom also invokes absent figures (other teachers, government agencies, and even traditional authorities) through rhetorical strategies that reinforce his position. By speaking on behalf of these figures, he lends authority to his claims and aligns his future practice with a broader social mission. These shifts in footing demonstrate the fluidity of voice in dialogic storytelling and exemplify Bakhtin's notion of the self as constructed through a dynamic interplay of others (Bakhtin, 1981; Cooren et al., 2013). In this context, *footing* refers to the speaker's shifting stance or alignment as they animate different voices, revealing how identity is dynamically constructed through dialogic interaction and ventriloquized perspectives (Bakhtin, 1981; Cooren, 2012).

Ultimately, this study highlights how a preservice teacher's story can reveal much more than pedagogical preference. Although Wisdom did not describe a personal experience with authentic PBL, his narrative demonstrates a clear recognition of its potential to nurture student agency. He values PBL for its capacity to promote inquiry, encourage learner autonomy, and connect classroom learning to real-world issues, key features that scholars have identified as central to PBL (Hmelo-Silver, 2004; Savery, 2006). Wisdom alludes to these dimensions in his appreciation for hands-on methods and his belief that students can carry knowledge into their communities and influence behavior. For example, he imagines students applying environmental practices at home, effectively becoming agents of change beyond the school setting. These reflections suggest that Wisdom understands PBL not simply as a pedagogical tool, but as a framework for empowering learners to respond to complex societal challenges.

Through the voices he animates (those of students, teachers, parents, and community members) Wisdom constructs a vision of teaching that is not only responsive but transformative. His account positions PBL as a vehicle for equipping students with the critical thinking skills, collaborative dispositions, and ethical awareness needed to address pressing environmental challenges in their communities. In this way, ventriloquism becomes a method through which Wisdom performs both a pedagogical critique and an aspirational stance. His story, grounded in personal experience and animated by a multitude of voices, is both personal and political. His voice emerges as one shaped by many, yet distinctly his own. Through this dialogic performance, Wisdom presents himself as a ventriloquist of hope, resilience, and educational change.

CONCLUSION

This study set out to explore how a Ghanaian preservice teacher, Wisdom, constructs his understanding of PBL and environmental education through the lens of Bakhtin's *Ventriloquism* and *Voice*. Wisdom's narrative reveals that teacher identity and pedagogical commitment are not formed in isolation but through the dynamic

interplay of personal experience, institutional structures, social expectations, and environmental realities. By tracing the polyphony of voices within his story; those of former teachers, family members, communities, government institutions, and imagined students, this study illustrates how ventriloquized discourse shapes the meanings Ghanaian preservice teachers assign to teaching, learning, and change-making. In doing so, it advances understanding of how teacher identity is discursively constructed in the Ghanaian context, addressing a gap in the literature on preservice teacher development by foregrounding the role of socially inherited narratives in shaping educational agency. Wisdom's vision of teaching emerges as both a personal mission and a civic responsibility, grounded in the belief that education can be a vehicle for environmental and social transformation. His reflections not only illustrate the practical tensions of implementing PBL in resource-limited contexts, but also foreground the powerful role teachers can play in preparing students to become active, environmentally literate citizens. By focusing on voice and intentionality in a single teacher's narrative, this study underscores the value of dialogic methodologies in teacher education research. It also invites further inquiry into how future educators in Ghana and beyond make sense of their professional roles amid the complexities of social and environmental change.

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APPENDIX A

Interview protocol

Background Demographic Information

1. What is your name?
2. What pseudonym would you like me to assign to you for the purpose of this study?
3. How old are you?
4. How do you identify yourself in terms of your gender?
5. What program (elective subjects) did you study during your senior high school?

Interview Questions

1. Reflecting on your own experiences as a student, what qualities or approaches from your teachers had the most significant impact on you, and how do you plan to incorporate them into your teaching practice?
2. Can you describe the kind of learning environment you aim to create in your classroom, and how you believe it will positively influence your students?
3. Of all the instructional models, which one resonates most with you and why?
4. What do you understand by the term problem-based learning?
5. Can you share an example of a problem-based learning activity you participated in as a student?
6. How did you feel about the approach? How did problem-based learning contribute to your understanding of the topic?
7. What are your views on Climate Change?
8. Please describe any environmental stewardship activities you are currently engaged in or have participated in previously.
9. What environmental issues are prevalent in your community?
10. How important do you think it is for students to be involved in addressing environmental issues in their communities?
11. How do you think problem-based learning can enhance students' understanding of environmental science concepts compared to traditional teaching methods?
12. In your opinion, what are the key benefits of incorporating problem-based learning in teaching generally and especially in environmental science?
13. How comfortable do you feel about your ability to implement problem-based learning in your teaching practice? What challenges do you anticipate and how do you plan to address them?
14. Do you believe problem-based learning can foster a sense of responsibility and agency in students towards environmental stewardship? Why or why not?

APPENDIX B

Canes Made Us Timid: The Story of Wisdom

Wisdom is a 21-year-old male preservice teacher in his third year at Birim College of Education, located in Ghana's Bono East region, a predominantly Guan-speaking area with a rich history of trade and commerce. Originally from Yeji, a town about an hour and twenty minutes from his college, Wisdom comes from a middle-class family. His mother is a trader, his father a teacher, and he has two siblings. He performed well academically throughout his K–12 education and now feels prepared to pursue a career as an elementary school teacher. In high school, he chose a science concentration and recalls a mix of encouraging and discouraging learning experiences. What stands out most in his memory is the emphasis on doing science (experiments) and memorizing facts, rather than truly understanding the concepts. His favorite subject was biology because in his words, his teacher was young and used humor to make his teaching simple. Physics, by contrast, was not a subject Wisdom associates with positive memories. Attending the class felt burdensome; although it was an elective, it was simply something he had to pass. His engagement was minimal, and skipping class became a coping strategy to deal with the unwelcoming and tedious learning environment. His physics teacher enforced discipline using a cane—an outdated and authoritarian tactic. As a result, most students, including Wisdom, feared the teacher and never developed any real interest in the subject. Unfortunately, the school culture discouraged students from reporting such incidents to the school principal due to fear of retaliation. Many also believed that speaking up would either lead to no change or worsen their situation. As a result, they chose to remain silent and adapt to caning in the physics class.

Wisdom's responses become more detailed when he describes his learning experience in chemistry class—a subject, along with biology, that helped rekindle his interest in school. Chemistry, like biology, was one of the few classes where students engaged both physically and intellectually with the content. Wisdom especially looked forward to lab sessions in these subjects, recalling them as moments filled with excitement and fun. He points out that "the master would send us to the lab so we can put our hands in the things that we do in class." He is referring to 'seeing' and 'touching' the products of science they discussed and learned about in the classroom. Similarly, Wisdom speaks about his English class with noticeable enthusiasm, describing it as a subject where he felt encouraged to 'go deep in the investigation of a topic. The teaching strategy in this class positioned students as independent learners investigating a question or issue posed by the 'master.' For Wisdom, this approach led to a deeper understanding of the topic—one he found more meaningful than traditional, lecture-based instruction. Now in his position as a soon-to-be elementary teacher, he envisions a similar learning environment for his own students. Wisdom insists on having a classroom that is not rigid; he means a place "where children feel free, at home; and where they can express and share their own knowledge and thoughts—they should not be timid," he points out. In Wisdom's classroom, his students will participate in self-governance; they will set the classroom rules. He makes it clear that the "teaching is not going to be done by him all the time; [he] is not going to be feeding them knowledge." In describing his vision for his future classroom, Wisdom recalls the 'cane' as a symbol of the rigidity that defined his physics class—a learning environment that left him with a negative perception of teaching. When asked about the potential impact of his future teaching on students, he responded by reflecting on the 'kind of citizens' he hoped to help shape in his country. He sees apprehension and timidity in the current citizenry; "they are not brave enough to talk about, to talk about things that need to be done." He explains that this attitude has its roots in the experiences that they had as children in the classroom. He emphasizes once again that in his classroom his students will be bold and brave to say anything, even if it is wrong. This teaching ideology may have its origin in the experiences with his own family. His dad chose the teaching profession for him. He highlights that "he was young and did not have control over what he would like to do after high school, plus he did not have the courage and boldness at that time; he knew whatever his dad says or does for him is going to be good." In fact, he is not regretful about this choice because "teaching is one of the best professions that someone can take care of." He sees education

as an impactful factor in the development and future of his country. His goals and aspirations as an educator appear to be informed by the reality he sees around him, and education, in his view, is the tool that can "help them get better situations around them and in the country." For instance, one issue that concerns him is the prevalence of teenage pregnancy. As he elaborates, he attributes its occurrence to a lack of understanding of the consequences among women in his region. He is confident that education can change this situation; he argues that "they [women in his region] do not seem to understand the importance of or the effect of some decisions that they take." He acknowledges that multiple factors contribute to the issue, some of which are tied to the family structure in his community—though he chooses not to elaborate on them.

Wisdom is also concerned about pressing environmental issues in his community, particularly the lack of sanitation in densely populated areas where inadequate housing is a major contributing factor. These conditions contribute to broader problems such as poor waste management and the deterioration of water resources. Despite how discouraging these challenges may seem, Wisdom finds hope in education—particularly in the time teachers spend shaping the minds of young learners. He argues that children spend a considerable amount of time in school with teachers, and explains, "when we try to teach them about proper waste management practices, they go home and influence their parents to do the right thing." He is confident that this is a reasonable option because he witnessed it at home; when their siblings would come home from school and tell him about what they had learned in school; "they were my teachers," he says. He also believes that getting the whole community involved is essential in tackling environmental issues. Mobilizing the community, he thinks, will empower them "to go to the chiefs and community leaders to talk about the issues affecting the community." At the global level, environmental issues like climate change have also impacted Wisdom's community. Coming from a family of farmers, he has witnessed its effects firsthand, particularly on corn cultivation, the main crop on his family's farm. Irregular rainfall throughout the year has made farming increasingly unsustainable, and he believes that human-induced factors are largely to blame.

Currently, Wisdom is in the third year of his education program and already imagines himself in his new role as a brand-new elementary school teacher. Among his preferred instructional strategies, Wisdom highlights hands-on learning and Problem-Based Learning (PBL). He values these approaches because they allow students to engage actively with content rather than relying on memorization, an approach he sees as an effective way to avoid 'this thing called rote learning.' He sees PBL as similar to hands-on learning in that it also requires students to engage in practical work. Although he doesn't recall being formally engaged in a PBL session during his education courses, he considers it a promising instructional approach because of its lasting impact on student learning. According to Wisdom, PBL enables students to develop a strong understanding of an issue by actively engaging with it, ultimately allowing them to generate solutions grounded in their own work and lived experiences. While Wisdom feels confident about starting his teaching career, he also recognizes the value of additional training, particularly in implementing diverse instructional methods, including PBL. He is also aware that the lack of instructional resources such as textbooks, libraries, computers, and internet access in public schools poses a significant challenge. However, this does not diminish his commitment to becoming a public-school teacher.

Wisdom will soon enter the classroom, not with a cane, but with a deep sense of purpose and hope for a better future for his community and country. He envisions a generation of citizens who can contribute to solving pressing local issues. With that goal in mind, he is committed to preparing his students to be courageous, to raise their voices, and to advocating for the changes their communities need.