"Step Outside": A portrait of an exemplary rural K-8 science educator

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Abstract

This study uses portraiture methodology to co-construct and share the story of a nationally-recognized rural K-8 science teacher with more than 30 years of teaching experience. Our analysis and synthesis revealed one central theme "Step Outside" and three subthemes: (1) Step Outside of the Rural Classroom, (2) Step Outside of the K-8 Teacher's Comfort Zone, and (3) Step Outside of Science Silos, that have been central to the teacher's personal and professional journey. Examining the ways these subthemes have intersected across the career of an exceptional rural teacher offers valuable insight to the development of teacher identity and how it shapes practice and research, especially within marginalized contexts such as K-8 science education and rural settings.

Keywords: K-8 science, rural, portraiture, teacher identity, place-conscious pedagogy

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> Science is what brings our kids to school, since it is grounded in local relevance, makes other subject matter meaningful, and is simultaneously fun and of serious importance... I'm always telling my students, "You are scientists, and you can solve important problems." (a highlight from Judy's portrait)

Although rural contexts offer unique challenges—and possibilities—for teaching and learning science, and despite the reality that 20% of US K-12 students attend rural schools, these schools are largely invisible in research (Moffa & McHenry-Sorber, 2018; Showalter, et al., 2019). Similarly, the stories of successful practicing teachers in rural communities and the ways they form and enact their teaching identities have long been marginalized, as the focus of teacher identity research is often on urban and suburban education (Biddle & Azano, 2016; Petrone & Wynhoff Olsen, 2021). Scholarly inattention to these rural spaces and experiences results in an incomplete picture of contemporary science education and ignores the implications rurality holds for curricular design, policymaking, and teacher education. Most importantly, this neglect reinforces broader marginalization of rural spaces throughout science education, which in turn limits access and opportunities for rural students. As the National Academies of Sciences, Engineering, and Medicine 2021 *Call to Action for Science Education* summarizes, "many students, particularly students who live in poverty, Black, Latino/a, and Indigenous students, and students living in rural areas, have lacked access to high-quality science education across K-16 and have been shut out of many opportunities in STEM" (p. 8).

Rural schools often serve students who live in sparsely populated communities sprinkled throughout geographically diverse areas (Avery, 2013; Petrone & Wynhoff Olsen, 2021). Just as the geographic features of these communities vary vastly from place to place, so does the "rural social space" (Reid et al., 2010) that consists of social, economic, and environmental dimensions. As each rural place is unique and complex, seeking to generalize specific research findings across geographic space proves challenging and inappropriate. Community members in rural settings often note the best way to learn about the complexities of a place is to listen deeply to the story of an expert with lived experiences within that context. Such "research as conversation" often demands innovative or even "transgressive" methodologies in rural contexts (Howley & Howley, 2014, p. 9, 15).

The primary purpose of this article is to advance understanding of how teachers can develop resilient and successful identities as K-8 science educators within rural contexts. By using portraiture methodology we co-construct and share one rural teacher's lived experiences and the ways she thinks about teacher identity in a way that is accessible, engaging, and relevant. A secondary purpose of this article is to illustrate the potential of portraiture to advance knowledge about rural science teacher identity development while simultaneously offering a methodological model essential for future research in rural contexts. Portraiture is a participatory narrative methodology that allows for co-construction of a "written picture" of lived experiences, teacher thinking, and identity development (Jaime, 2008, p. 220). Within portraiture, "the portraits are designed to capture the richness, complexity, and dimensionality of human experience in social and cultural context, conveying the perspectives of the people who are negotiating those

experiences" (Lawrence-Lightfoot & Davis, 1997, p.3), so it is well-suited for sharing individual, complex stories such as those shaping the careers of rural K-8 science educators.

Through co-constructing and sharing the story of a leading rural science teacher, this study seeks to answer the following research question: How does an expert rural teacher think about and describe the ways she enacts her teaching identities and practice? Three interconnected sub-questions further framed the study: (1) What experiences and contexts helped shape the expert K-8 rural science educator's teaching identity? (2) What experiences and processes shape development of the portrait? and (3) How can this portrait, and portraiture as a methodology, help science education researchers better understand the challenges *and* possibilities that exist in rural science education contexts?

Literature Review: Rural Teacher Identity

Rural Contexts and Science Education

Researchers and policymakers often make the mistake of assuming rural spaces are homogenous, but as Corbett (2016) writes "if you have seen one rural community, you have seen…well, one rural community" (p. 278). One aspect that *is* common across diverse rural communities is the tendency for scholarship to emphasize perceived deficits. Too often, rural teaching is seen as unappealing due to overly-negative narratives permeating the limited literature (Moffa & McHenry-Sorber, 2018). Without over-emphasizing these negative assumptions, it is important to recognize rural schools face unique hurdles, including deep persistent poverty, hard-to-fill teacher positions, limited access to professional development, and fewer STEM course offerings (Lovalley, 2018).

Rural schools struggle to recruit and retain qualified teachers (Azano & Stewart, 2016), especially those with strong STEM backgrounds (Lovalley, 2018). Unique challenges associated with rural teaching include limited networking, mentoring, and professional development opportunities, as well as the expectation to teach multiple courses and ability levels at the same time (Lovalley, 2018). In a phenomenographic study of six rural high school science teachers, Goodpaster et al. (2012) reported that the teachers play multiple roles within their schools and surrounding community. The complex workload and social expectations, coupled with a lack of content expertise and limited access to professional learning opportunities, can lead to high teacher turnover rates in rural schools (Arnold et al., 2005; Lovalley, 2018). Despite these challenges, rural contexts also present unique and beneficial STEM teaching and learning opportunities. Teachers have reported numerous benefits of teaching science in their rural schools, including (1) mutual trust between community members, (2) willingness of community members to become guest experts on various science topics, (3) more control over what is taught in the classroom, and (4) opportunities to connect science content to rural life through local agriculture (Goodpaster, et al., 2012). While Goodpaster and colleagues (2012) highlight some of the benefits of teaching in rural schools, there is still much to be learned about teaching science within these contexts. Research that examines experiences of those science teachers who persist and thrive in rural schools can help identify ways to support rural science teachers, reduce teacher turnover, and improve access to high quality science instruction for rural children.

Science Teacher Identity and Rural Teaching

Rural spaces are often characterized by strong kinship ties and a deep connection to shared community values, with the school often serving as the center of social, cultural, and recreation activities within the community (Miller, 1995; Seal & Harmon, 1995). The rural teacher, then, who is the "face" of the rural school, often must negotiate her teaching identity under scrutiny of the larger community. The unique settings in which rural teachers develop their identities warrant expanded attention, as they play out in very different ways than the identity development of their urban and suburban peers.

Teacher identity development is fluid, multifaceted, socially constructed, and linked to the places and contexts in which teachers work (Avraamidou, 2014a; Wenger et al., 2012). Teaching identities are constructed through a constant negotiation process of meaning making as a teacher interacts with others (Avraamidou, 2014a; Wenger et al., 2012; Lave & Wenger, 1991). This process is situated within the context of place and cannot be separated from social and cultural contexts (Torres Olave & Dillon, 2022). There is a close connection between identity, practice, and teacher development (Avraamidou, 2014b; Wenger, 1998). In a review of literature, Avraamidou (2014a) further demonstrated that teacher identity research illuminates ways that social markers impact teacher development and how teachers' personal histories relate to science. Thus, it is important that rural teacher identity development be examined through methodologies that allow the researcher to closely connect with the teacher within the context of their unique spaces.

Over the last ten years there has been an increase in research related to science teaching identity, mostly focused at the middle and high school levels. In a study of secondary science teacher identity, Helms (1998) illustrated the importance of subject

matter to identity development, suggesting that teachers must know who they are in respect to the subject matter they teach. Unfortunately, many elementary teachers do not identify as teachers of science, and most prefer teaching reading and language arts over other subjects (Mensah, 2016; Wilkins, 2009). This potential connection between lack of science teaching identity and lack of commitment to teach science points to a need to explore elementary science teaching identity more fully, with Avraamidou (2014b) stressing the value of studies examining experiences throughout a science teacher's life.

Avraamidou (2014a) points to the need for additional research on factors that impact identity development, such as context, experiences, and relationships. Particularly, we note intersecting gaps in the literature between K-8 science teacher identity and rural teacher experiences. Broader studies of teacher identity, especially those using narrative methodologies, provide insight into the conditions of educators' work, the dilemmas they face, and the ways they cope (or not) with educational change (Beijaard et al., 2004).

Conceptual Framework: Place-Conscious Pedagogy and Research

This study centers place—especially rural places—to better understand how context influences science teaching and teacher identity development. According to Gruenwald (2003) places "make us" by shaping our culture and identity. Rural communities often have a very strong sense of place, which impacts decisions related to education (Barter, 2008). Rural places can provide powerful opportunities for transforming perceptions of science education, especially in their potential to increase appreciation for local funds of knowledge (Avery, 2013; Avery & Kassam, 2011; Goodpaster et al., 2012; Gruenewald, 2003). Although "teaching and learning always are placed endeavors," teachers, teacher educators, scholars, policymakers, and curriculum

developers too often neglect the role of context in education (Eppley, 2015, p. 69). For example, teacher preparation programs frequently use a generic approach to education that prioritizes the needs of urban and suburban schools (Barter, 2008). Unfortunately, neglecting or misunderstanding the influence of place on teaching and teacher identity development leaves new teachers especially ill-prepared for teaching in rural settings (Goodnough & Mulcahy, 2011; Moffa & McHenry-Sorber, 2018). Therefore, it is important to consider "context not simply as a backdrop for teaching and learning, but as constitutive places that shape identities and possibilities" in positive ways (Eppley, 2015, p. 70).

Educational research has also long neglected the influence of place, and rurality in particular, upon its theories and methodologies (Butler & Sinclair, 2020). To situate a strengths-oriented study about science teaching identity within a rural context, we look to Gruenewald's (2003) place conscious pedagogy and portraiture methodology (Lawrence-Lightfoot & Davis, 1997). Gruenewald's framework introduces five "dimensions" (perceptual, sociological, ideological, political, and ecological) of place. These dimensions frame place as intertwined with peoples, histories, and knowledge systems. Gruenewald's framework, therefore, recognizes specific places as complex and multifaceted spaces. Similarly, leading portraiture scholars Lawrence-Lightfoot and Davis (1997) describe context as the integration of the "physical, geographic, temporal, historical, cultural, aesthetic within which the action takes place" (p. 41).

Methods: Portraiture as a Lens into Rural Science Teacher Identity

To advance understanding of rural science teaching and teacher identity, particularly through a place-conscious lens, we applied the qualitative, narrative, and

participatory methodology of portraiture. As qualitative research is a "situated activity that locates the observer in the world… [and] consists of a set of interpretive, material practices that make the world visible" (Denzin & Lincoln, 2011, p. 3), it is generally well-suited to deep investigation of intersections between place and identity. Narrative approaches, which attend to "experiences as expressed in lived and told stories of individuals" (Creswell & Poth, 2018, p. 67), can support place-conscious identity research in rural communities (Kvalsund & Hargreaves, 2014). Participatory research that engages researchers and participants in ongoing conversations throughout the research process to examine their "shared reality," offer enhanced ways to ensure place-conscious analysis and trustworthiness within rural education research (Howley & Howley, 2014, p. 16). As opposed to a set of static methods, participatory orientations to research acknowledge community members as essential partners in shared design, implementation, analysis, and dissemination of research (Northway, 2010; Stanton, 2014).

Portraiture: Possibilities and Challenges

For this study, portraiture offered a way to intentionally integrate the physical, geographic, temporal, historical, cultural, and aesthetic narrative elements (Lawrence-Lightfoot & Davis, 1997) important to advancing deep understanding of a specific context and individual's identity development. Portraiture situates noteworthy individual life stories within the "aesthetic whole" created by complex social, professional, and cultural contexts (Lawrence-Lightfoot & Davis, 1997; Quigley, et al., 2013; Given, 2008). In terms of science education, portraiture is especially valuable in understanding minoritized and marginalized experiences. For example, Tolbert, et al. (2022) described

the potential for portraiture to understand feminist praxis in science education. Scholars note portraiture's ability to define and refine professional identity for science teaching and to connect research and practice (Quigley et al., 2013; Tolbert, et al., 2022). Despite its potential, portraiture remains "an underutilized methodology in science education research" (Quigley, et al., 2013, pp. 41-42). Only a few science education studies used portraiture (e.g., Larkin et al., 2009; Mulholland & Wallace, 2005; Quigley, et al., 2013; Tolbert, et al., 2022), and our literature review did not identify any portraiture studies focused on the intersections of rurality, elementary education, and multi-grade teaching.

To simultaneously ensure methodological rigor and practical accessibility, portraiture is framed by *context, voice,* and *relationships* (Lawrence-Lightfoot & Davis, 1997; Quigley, et al., 2013). Therefore, portraiture recognizes the importance of *context* and place-consciousness (Gruenewald, 2003) within rural education research (Corbett & White, 2014). Another primary goal of portraiture is to "give honor to [a participant's] *voice*" (Hill, 2005, p. 96, italics ours), so it is well suited for research that explores marginalized stories, contexts, and experiences, such as those of rural science educators. Portraiture cultivates trusting *relationships* between teachers and researchers that are vital for developing deep understanding about teacher thinking and identity (Lawrence-Lightfoot & Davis, 1997; Quigley, et al., 2013).

Our Positionalities (and Repositioning) as Co-Researchers

Given the importance of relationships and co-construction of knowledge throughout portraiture processes, we recognize the value of sharing explicit positionality statements for all three co-researchers as well as information about our relationships with each other. As co-researchers, we (Becky and Christine), serve first and foremost as

"witnesses" to Judy's story. As co-portraitists, our secondary role has been to shape the representation of Judy's story to communicate effectively with the intended audience (i.e., teacher educators, educational researchers) while preserving an artistic quality.

Judy. Judy is the focal teacher of the portrait, so much of the description of her background and positionality emerges directly through the portrait. Like the overwhelming majority of teachers in the U.S., Judy identifies personally and socially as a white, middle class woman. Over the course of her career, she has also developed a strong professional identity—and national recognition—as a leader of rural science education. She has over 30 years of teaching experience, 22 of which have been in a one-room, multi-grade (K-8) school. She is a recipient of the Presidential Award for Excellence in Mathematics and Science Teaching (PAEMST) and has served as the president of the Montana Science Teachers Association (MSTA) and the Elementary Representative for the National Science Teaching Association (NSTA).

Becky. Becky, who is also a white woman, grew up on a dairy farm in rural Appalachia, attended small predominately white rural schools, and had almost no exposure to racial diversity or non-Western knowledge systems throughout her K-12 education. As a first generation college student, she originally studied animal science. It was during college that Becky first saw the connection between school science (i.e., animal science coursework) and home life (i.e., activities on family farm) and began to question why her K-12 teachers did not identify these connections for her. During graduate school, she began working with Indigenous students through a STEM tutoring program at a local school district, inspiring a career shift from animal science to

education. Becky spent 12 years as a middle school science and engineering teacher in Title I schools located in rural and mid-sized towns in Oklahoma.

During her early years teaching science, Becky would hear students ask "Why do I need to know this?" which made Becky realize that just like her own K-12 teachers, she was not doing enough to connect classroom science to children's lives outside of the classroom. This resulted in a shift in Becky's teaching philosophy and sparked an interest in continuing her own educational journey to learn more about the ways in which local knowledge can inform curriculum development and shape rural and indigenous children's science and engineering identity development. Like Judy, Becky is a PAEMST recipient, and this shared connection led Becky to reach out to Judy to learn more about her approach to teaching K-8 science and purposefully connecting school science to the local space. Becky's personal experiences as a K-12 student and teacher, as well as her scholarly interest in K-8 teachers' science and engineering identity development and place conscious science instruction form the lens through which she interprets Judy's teaching and personal stories.

Christine. Like many people in the West and Midwest, Christine has multi-generational connections to rural contexts across the region. The bulk of her experience as a teacher, teacher educator, and educational researcher has focused on teaching/learning within rural and reservation communities. Christine's early childhood was spent in a small farming community in Nebraska, with annual visits to her maternal grandparents' home in north central Montana, which was located on the homelands of the Blackfeet Nation. In fourth grade, her family relocated to a community in Wyoming. Across these contexts, Christine was surrounded by people who worked on the land as

farmers, ranchers, and oil and gas extractors. The backgrounds and experiences of these people largely mirrored her own: They were almost exclusively white European Americans with place-based identities situated in views of land as a resource or property.

Throughout her post-secondary education, Christine began learning about the complex and continued ways that settler colonialism has shaped and disrupted understandings of rural places. After college, she returned to Wyoming, where she worked as a teacher and instructional coach for small, geographically isolated school districts and learned about relationships between places, knowledges, and education from Eastern Shoshone and Northern Arapaho youth and leaders. Given her own personal and professional journey, Christine came to this project interested in the journeys of other rural educators, especially those with deep commitments to environmental conservation and recognition of Indigenous knowledges.

Repositioning our Team. Research in rural contexts is a "risky business" in its need to resist conventional expectations (Henderson & Lennon, 2014, p. 119). To listen deeply and engage in conversation *with* community partners, such research demands a participatory orientation that repositions community members as experts and academic researchers as co-learners (Henderson & Lennon, 2014; Northway, 2010; Petrone & Wynhoff Olsen, 2021; Stanton, 2014). In the case of this study, our relationships with each other are rooted in co-learning, dialogue, and mentorship. Judy was an integral part of the research team as she guided the interpretation, supported connections to research literature, offered implications and recommendations for future research and practice, and—most importantly—provided mentorship for Becky and Christine in terms of understanding a place-conscious science education, particularly in terms of rural settings.

Becky supported learning for Judy and Christine in terms of STEM education theory, research, and practice, especially within elementary and rural classroom contexts. Christine provided mentorship in innovative and participatory qualitative methodologies, particularly as implemented within rural contexts. Our relationship was integral to the co-construction of the portrait, with aspects framed by our various perspectives.

Data Sources and Collection

Formal data collection included observations of Judy's teaching practice and context, in-depth interviews about Judy's life history and teaching experiences, interviews and participatory sense-making sessions (De Jaegher & Di Paolo, 2007) to collaboratively discuss elements of the portrait, and review of artifacts such as curricular resources and student science notebooks. Over the span of 2.5 years, Becky and Christine compiled field notes, researcher memos, and video recordings to document eight multi-hour observations of Judy and her students in both classroom and outdoor teaching and learning contexts. During these observations, Becky also explored various teaching and learning artifacts, such as students' science notebooks, which play a central role in guiding science education for Judy's multigrade students. Our field notes and memos included summaries of activities, descriptions of content and artifacts, and salient quotes from Judy and students. Together, these data sources allowed for deeper, contextualized questioning during the in-depth interview and participatory sense-making sessions (e.g., "Every day when the children come into the classroom, they care for the plants on the windowsill. How does this part of the daily routine demonstrate your views of teaching science in this space and place?").

The central in-depth interview spanned nearly three hours and was recorded and transcribed. Each of the seven areas of questions (growing up, education, career, educational philosophy, science teaching, context, and mentorship) in the interview protocol adapted from Quigley et al. (2015) included guiding sub-questions (e.g., What is the purpose of teaching science to rural students? What does science teaching/learning look like in your classroom?), although we encouraged Judy to share her story organically. Two additional interviews and participatory sense-making sessions, which we recorded and transcribed, supported data crystallization and provided opportunities for collaborative analysis and discussion.

Analysis, Co-Construction, and Representation of the Portrait

Typically, qualitative researchers analyze data by fragmenting it through multiple rounds of coding, then they re-synthesize it by identifying patterns and broad themes. Portraiture analysis enacts subtle differences when compared to other qualitative methods. It seeks to keep larger segments of data intact and identify repetitive refrains and resonant metaphors (Hill, 2005, 2012; Lawrence-Lightfoot & Davis, 1997; Tolbert, et al., 2022). It also attends to deep analysis of "institutional and cultural rituals" through collaborative exploration of participant stories (Tolbert et al., 2022, p. 141).

For educational research in rural contexts, scholars note the importance of collaborative analysis and "research as conversation" with teachers, further bolstering the need for relational and participatory methodologies such as portraiture (Howley & Howley, 2014, p.15). In this study, data analysis consisted of multiple phases, ongoing member checks, and participatory sense-making sessions. Together, these iterative elements supported development of the portrait. Multiple phases shape the portraiture

process, notably conception, structure, form, and cohesion (Tolbert, et al., 2022), and each of these phases included both independent and collaborative aspects. Specifically, we enacted a round of open coding, a round of focused in vivo coding, a round of code mapping and axial coding, and co-construction of the portrait–which included additional interviews and collaborative sense-making–to illuminate patterns and themes.

Our initial analysis consisted of a round of open coding to organize and connect the interview and observation data. After transcribing the central interview, Becky and Christine each lumped sections of the transcript and assigned codes to express the "critical events," or the turning points in Judy's story, that emerged. During this initial review, we also identified repetitive refrains (e.g., "watershed project") and resonant metaphors (e.g., "wearing hats") that could serve as salient examples of Judy's philosophy and experience in practice. Following the live observations of Judy's teaching, we reviewed the video recordings to verify and expand upon the field notes and memos made during our visits to Divide. In some cases, video review provided new insights, during which we generated new field notes and/or memos. Additionally, the video review offered opportunities to identify and verify wording of quotes or refrains shared by Judy and students. Finally, the observation data provided opportunities to identify additional codes and/or to reaffirm codes that had emerged during the open coding of the central interview transcript. For example, when Judy asked her students about the reasons for wearing their lab coats, we were able to connect observed behavior to interview content ("students are scientists" who "can solve important problems").

Our second round of analysis consisted of individual focused in vivo coding of both the central interview transcript and the field notes and memos we had independently

created during our observations and video review. In vivo coding, which expresses key codes and themes using the participant's own words, is well-suited to portraiture and other participatory research, given its recognition of participant voice. For this phase, we revisited the recurring and salient refrains from the interview, and then we identified those that also appeared in Judy's observed teaching practice (e.g., "students are scientists").

Following the first two rounds of coding, Becky and Christine met to engage in collaborative "code mapping" and categorizing (Saldana, 2016), which linked the codes and critical events we each had independently identified. The resulting concept map served as our guide during a final round of axial coding, during which central categories provided hubs to link sub-categories and illuminate relationships and contexts connecting critical events (Saldana, 2016). We also re-examined recurring in vivo codes (e.g., "students are scientists!") to ensure these codes were represented in the refined concept map. The completed map (Figure 1) framed our investigation into one central category/theme ("Step Outside") and three sub-themes ("…of the rural classroom," "…of the K-8 teacher's comfort zone," and "…of science silos"). Figure 1 guided our organization of the coded and categorized data in preparation for drafting the portrait.

While most qualitative analysis concludes with coding and categorizing, portraiture demands additional components related to the co-construction of the portrait itself. During this phase, we included additional interviews and collaborative sense-making sessions with Judy. These conversations also included sharing video recordings, field notes, and memos with Judy, then asking her to "think aloud" as she observed her own teaching. These sessions also provided opportunities to discuss logistics related to

the portrait and this article. For example, we talked through ideas for and challenges of organization of the narrative (e.g., trying to weave voices of all three researchers into the story). Then, we drafted and discussed several variations of the portraits. Given our conversations surrounding both the content and process of creating the portrait, we agreed to center an example (the Watershed Project) to ensure cohesiveness of the examples and quotes we incorporated. We also shared various drafts and options with colleagues and current and former students (i.e., pre-service teachers) to ensure readability.

The final analytical step in portraiture research is to highlight the portraitists' key impressions as well as lessons shared by the expert "subject" of the portrait. This step "looks across patterns of action and sees the whole" (Lawrence-Lightfoot & Davis, 1997, p. 87) through description of holistic themes, elements of portraiture, and/or connections to scholarship. While we recognize that a single study—even one that employs portraiture—will never be able to do justice in terms of sharing Judy's full career and experience, we also note the many rich insights this portrait offers for educational researchers, as well as for practicing teachers, teacher candidates, and teacher educators.

Context: A Rural Schoolhouse under the Big Sky

A central feature of portraiture is thick description of the context. Divide, named for its location near the Continental Divide, sits in the Big Hole River Valley and is home to roughly 200 people. Once the home of a major Union Pacific Railroad shipping station, today, the town's economy is driven by ranching and tourism associated with the Big Hole Recreation Area. The school's website highlights the "huge playground" that

shapes learning at the school that is "nestled between Mt. Fleecer and the Big Hole River."

The Big Hole River begins in the glacial high country of the Bitterroot Mountains and winds through forests, farmland, and semi-arid prairie for more than 100 miles before joining the larger Jefferson River. Together, the river and its tributaries provide nearly 3,000 square miles of habitat for many animals, including moose, elk, deer, bear, mountain lions, bobcats, and four species of trout. The Big Hole is also the last wild habitat for fluvial Artic grayling in the lower forty-eight states.

Before invasion by white trappers, military, and settlers, dozens of Indigenous Nations, including the Piikani, Sélisš, Agai'Dika, and Ktunaxa stewarded the lands of the region, and the watershed remains culturally significant to contemporary Indigenous peoples. Today, "Blue Ribbon Rivers" like the Big Hole and their surrounding areas attract fly fishing enthusiasts from around the globe, hunters, hikers, and other outdoor recreationalists. Given the semi-arid nature of the region and the short growing season, proximity to water, including that from the Big Hole watershed, is critical for the success of the expansive hay farms and cattle ranches that stretch across the valley.

The entire red Divide School building could fit into a typical high school gymnasium and is surrounded by farmland and snowcapped mountains. A second smaller building is located just behind the school, on the edge of the playground. Inside the front entrance to the school, there is a foyer with four doors – one to the girls' restroom, one to the boys' restroom, one to the main classroom and one to the science room. Along the walls of the foyer are five-foot tall, narrow cubbies where students' coats, gloves, backpacks, and other belongings are stored. Beyond the cubbies, hanging on the wall by

the main classroom door, are a dozen children's white lab coats in a range of sizes that would fit five- to fifteen-year-olds.

The science room is located to the right of the main classroom. There are rows of tabletop grow beds filled with flowers, vegetables, and native Montana plants. A large fish aquarium allows students to hatch and study Rainbow Trout that they later release into the wild. The walls are covered with student work, topographic maps, and posters. The center of the main classroom is filled with student desks, each labeled with a student's name. Pushed against the walls of the classroom are rolling work stations with large easel-style dry erase boards (covered with student work!) and baskets to store materials. Like the other classroom, there are signs of science everywhere – plants and rocks on windowsills, maps and posters on the walls, including a poster of the Next Generation Science Standards Science and Engineering Practices. There is also a large handmade sign on the wall that read, "Welcome CBS This Morning," a nod to the time when this little schoolhouse was featured on a national Sunday morning news program.

Findings: Portrait of an Exemplary Rural Science Teacher

In preparing to share Judy's portrait, we encountered a challenge noted by other portraitists: how to use analytical and dissemination practices common to qualitative research without compromising the complexity and richness of the lived experience and human story (Lawrence-Lightfoot & Davis, 1997; Tolbert, et al., 2022). Usually, the portrait is shared in a stand-alone section with interpretive discussion following. However, this format can prove confusing, especially in conventional research spaces where it is common to integrate descriptive analysis with examples of data.

For this article, we decided to share part of the portrait as the "context" section (see Methods, above) in order to set the stage for the portrait. In this Findings and Discussion section, we begin with a brief description of Judy followed by an uninterrupted segment of Judy's portrait, as shared from her perspective, to honor her career journey and voice. To demonstrate co-construction of understanding about Judy's story, context and relationships, we follow the portrait with a dialogue between the three of us. This conversation was recreated from our interviews and collaborative sense-making sessions. Finally, we conclude this section with additional discussion to situate elements of the portrait and our collaborative sense-making within the broader scholarship surrounding rural science teacher identity. Even with this format, as is true for all portraiture products, the lines between data and interpretation—and portrait and discussion—are blurry.

Judy's Journey: Becoming a Rural Science Teacher

Each day, Judy greets her students and visitors with a smile and sparkle in her eyes. Her long silver hair is often pulled back into a simple ponytail and her face adorned with trendy metal-rimmed glasses. Most days, she is stylishly dressed for comfort, fun, and function, wearing water resistant hiking shoes, colorful scarves, and multiple layers. She is slim and fit, and she radiates energy. We (Becky and Christine) have witnessed Judy as she accompanied her students out for recess in the subfreezing temperatures and played with them on the school grounds.

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I (Judy) love learning. Watching my students make discoveries gives me goosebumps. I still love learning. When I go to a professional development workshop, I

wonder, “Where are all the ‘grey hairs’?” Although I am technically a “grey hair”, I don’t think I’m a typical “veteran” teacher. But, not all parts of my story are filled with this positivity. As a student, I hated science. I *hated* it. In my K-12 education in New England, science was something confined to textbooks and copycat experiments. I was not a good student, particularly in terms of math and science.

I kept science notebooks at home. I would sit in my parents’ car during lightning storms, draw a picture of our backyard, time the lightning bolts, and describe what colors they were and where they were located. But, when I had science in school, I hated it. When I was sitting in the car I never considered myself doing science or being a scientist, because it was *exciting* and fun. I was controlling my learning, and it was empowering.

As a family, we were outside all the time… hiking, sailing, skiing. My parents and Girl Scouts were a really big influence on me in learning science. It was not school at all. Learning outside, or with my family, or as a Girl Scout *felt* different from science in school. It felt like science, it *was* science, it was the way science should have been taught. It's the way I wish science had been taught to me.

When I was a first year teacher, I was told to use The Science Book. But the book was *boring* and similar to the one that had turned me off to science as a student. If I’m bored, can you imagine how my students feel? No. That book isn’t where science is. Science is *outside.* Science is going outside and making observations and documentations, and then finding what you want to investigate. So, I began teaching science using experiences, outdoor settings, and student-centered inquiry in the one-room schoolhouse in New Hampshire where I taught. I would take my students outside to hike, complete “archaeological digs,” do field studies. I challenged them to explore the

historical cemetery, looking for who had the most children and what people did for occupations. My students mapped the region and identified the location of the school. I coordinated with teachers and students at other rural schools to create “treasure boxes” to teach each other about the different local areas. In the fall, my students studied and graphed moisture content and the leaf colors, and over time they started to monitor the weather and collect longer-term climate data.

The first few years of my career, I avoided the science workshops at the teachers’ conferences. I would never go, because I've always been intimidated by high school science teachers. They were so far above me, and I would feel like an idiot, and I'd be lost, and I felt it was a waste of my time. Then, I started learning how important science is to my students, and I said, “I've got to step out of my ‘science content comfort zone’.” And I said, “Okay, I'm gonna suck this up. And I'm going to tell them the truth.” Instead of separating myself, I sat right in the middle of all these high school teachers, and I said, “Hi, I'm an elementary teacher and I know nothing. Would you guys help me?” They were so excited, answering all my questions. At the end, I went up to the presenter and I said, “I cannot wait to teach this to my kindergarteners.” And he asked, “What? You would teach this to kindergarteners?” I answered, “They would soak this up! You should do more of this for elementary teachers.”

Now I think about science as a lens through which all other content—literacy, social studies, math, art, and so on—can be better understood. I’ve seen this happen again and again. For example, I had a student who had transferred to the school with low—the lowest of the low—reading scores. At the end of the student’s seventh grade year, as he was completing the year end reading assessment, he raised his hand, and I kind of jumped

to conclusions that he was going to ask for help. I went up to him and I said, “I'm sorry I can't help you” [since it was a test]. He said, “No, I don't need any help. I know all about this. We did this in science.” I got his test results back and it still brings tears to my eyes, he scored advanced in reading. Why? Because he had been exposed to the vocabulary, he could read *macroinvertebrate*, he knew what that word was because he had written it, he had spoken it, he had heard it. It had meaning to him. And suddenly I realized, how are these kids supposed to understand math or reading or science if they're not exposed to it?

To integrate multiple subjects across multiple grade levels, I developed several thematic units that I rotate through every four or five years. For example, kindergartners may experience a unit about physics and flight during which they build and test a simple “straw rocket.” When those same students are fourth graders, they may participate in another physics and flight unit, during which they are tasked with designing a more complex “water bottle rocket.” As eighth graders, those *same* students are expected to do something more complex, like maybe add a parachute to their rocket. Another key aspect of these rotating multigrade units is for students to teach their younger peers. The peer teaching is actually bi-directional, since the older students teach the younger students, but the younger students remind the older students to think outside of the box.

I have also noticed that younger students tend to ask more questions, and if they can’t answer those questions that year during their own inquiries and/or through the peer teaching, I encourage them to write the question in their science notebooks. I think of these notebooks as a history of students’ thinking, and in them students document their evolving, multi-year learning with detailed scientific sketches, hypotheses, data tables, and reflective essays. This is especially important as students re-encounter rotated units

and topics. One student said to me, “Well, I've already done this. I know what happens.” And I said, “Yeah, but in fourth grade when you did it, you came up with a list of questions of what you want to know more about. Go back and take a look at those.” She was like, “Oh, that's a great idea.” And then she starts flipping back, and she's like, “Oh, look at my handwriting, and look at my spelling. Oh my gosh, I did an awful job writing up this investigation.” And, “Oh, look how much better my drawing is here compared to here.” So, she got to see a whole measurement through her science notebook, of her growth, mentally, with investigations, and academically, with her writing and her reading and spelling and so on. The students always have that science notebook and can build on it.

Collaborative Sense-Making: Contextualizing Judy’s Story within the Watershed Project

Judy: When it comes to science, I want my students to have fun, but I also expect them to see themselves as scientists engaged in authentic and important work that has real consequences locally, nationally, and globally. After I moved west, I found bigger contexts for field study—all of our outdoor learning experiences are field studies, *not* field trips. In addition to science-specific resources, I started looking to interdisciplinary materials, especially those that promoted local knowledge and environmental revitalization. I also draw inspiration from professional development courses focusing on guiding student field inquiries, curricular resources and lesson plans developed by the *Clark Fork Watershed Education Program*, and aligned with the *Next Generation Science Standards*.

Along with students and community members, I launched the Big Hole

Watershed project 11 years ago. We work alongside leaders from Montana Fish, Wildlife, and Parks to apply on-site skills such as water quality testing and macroinvertebrate identification. For example, students learn about river ecology and the role of trout in the area ecosystem by hatching fish eggs obtained from a local hatchery and studying the hatchling fish until they are old enough to be released.

Becky: When I've witnessed students participating in the Watershed project, they are often wearing their hats and lab coats and documenting observations using both their science notebooks and electronic devices. Technology clearly plays a big part in the project. Each student has his/her own digital camera, digital microscope, and iPad. You [Judy] had to advocate for those resources and ask for support from the school board. In addition to high-tech tools, students also use easy-to-access or self-made resources.

Judy: The Big Hole Watershed Committee gave us a $100 donation and all my students got a Big Hole River Ambassador baseball hat. We bought lab coats that say Divide School scientists on them. We wear our lab coats when we're doing any science out in public. We wear them in Yellowstone National Park, we wear them when we do water quality testing, we wear them at science fairs. It's absolutely amazing because it puts the kids in the scientist mood. They *become* scientists. One day, one of the fishermen came over and asked, "What are you doing? What's hatching right now?"

Becky: I remember meeting the student scientists at a site designated by Montana Fish Wildlife Parks for the release of some of the trout they raised. The rain was intense that day and the temperature hovered just above freezing, but the weather didn't dampen the budding scientists' moods. One second grader enthusiastically shared with me what he knew about the fish's diet and its predators. He understood that this was about more than

releasing a few fish into the wild—he understood this fish's role in the larger ecosystem.

On one of my visits to the school, students were using papier-mâché mountains and jump ropes to create models of the Watershed. Even very young students showed understanding and enthusiasm as they recognized topographical features. Young and older students alike walked along the watershed model (that stretched across the entire classroom floor) placing labels representing the different landmarks and towns that were part of their local region. Students accessed knowledge from prior experiences to help them with this task, sharing stories about visiting other schools for sporting events ("I know a kid from Wise River who…") as they placed the labels for those communities. Students placed cards independently, but also worked collaboratively utilizing their collective knowledge to complete the Watershed model.

Christine: A powerful aspect of the Watershed project is its potential to help students think about the importance of the River to different communities, including those beyond Divide. I was eager to learn about how the Watershed project incorporates essential understandings for Montana's constitutional mandate, *Indian Education for All* (IEFA), especially since you and your [Judy's] students do not identify as Indigenous. You explained how you adapt state provided IEFA materials to ensure students can transfer what they learn to their contemporary context. For example, one lesson highlights the traditional and contemporary importance of the Bitterroot plant to the Salish. I love the story you shared about how, after the lesson, your students found a Bitteroot plant growing in the school's yard, and they fought to protect it by posting a "Don't Mow Over!" sign.

Judy: Like my students, I am white, and learning about IEFA is important for all of us.

Because of the IEFA constitutional mandate, Montana could not adopt NGSS in full as its state standards. Instead, they based the Montana Science Standards on NGSS and embedded IEFA into the standards. The unique IEFA embedded science standards bring Indigenous knowledge of science to light and bring a deeper understanding of nature to my students. There are other ways I bring IEFA into the Watershed project. As students learn about how mountain snowpack and river flow rates help predict the severity of the wildfire season, they also learn about traditional Indigenous uses of fires to revitalize habitat as we study the impacts of drought, climate change, forest management, and industrial agriculture throughout the Watershed. When we study Bull Trout reintroduction efforts, students learn about traditional Indigenous fishing practices and management in order to revitalize the habitat throughout the Watershed and region.

Becky: During each of my visits to the school, I witnessed the importance of relevance and sense of larger community. One time, parents drove for 2 hours to accompany the class when releasing the trout into the wild. Another example was when I attended 8th grade graduation for the Divide School class of 2019. I was expecting a small celebration attended by close family and friends, so I was surprised to see the community building filled with nearly 100 people there to celebrate the accomplishments of the graduating class of one. In many ways, community and family members are part of your classroom, especially when thinking of the classroom as the entire Big Hole Watershed. The board members, parents, and other community members trust you with the education of their children because they have witnessed the results, and—in many cases—joined in on the adventures by traveling along to conduct field research.

Judy: The river is close to my heart, because it is close to my students. It's their river.

The river makes science *real*. Science is what brings our kids to school, since it is grounded in local relevance, makes other subject matter meaningful, and is simultaneously fun and of serious importance. The Watershed project is all about fun *and* serious science. I'm always telling my students, "You are scientists, and you can solve important problems." For students engaged in field study in the Big Hole Watershed, those problems directly affect their families, their homes, and their own lives.

Discussion: Step Outside

As her portrait and our dialogue demonstrates, Judy's teaching identity has been formed through a lifetime of learning, vulnerability, creativity, and enthusiasm for the natural environment. Central to her journey, Judy has come to recognize access to local assets, resources, and knowledge as a means to cultivate rural science learning that is simultaneously fun and serious. Great rural K-8 science teachers like Judy take their students outside of the classroom, they step outside of their comfort zones to learn from others, and they engage their students in rigorous interdisciplinary inquiry.

Step Outside of the Rural Classroom

For Judy, much of the most relevant learning takes place outside of the traditional, physical classroom. As she explained, "Having the kids outside was just amazing. It's what started making them excited about coming to school. They started to learn about the world around them." Furthermore, if her students ask a question about a phenomenon that can be observed in the local environment, Judy notes that they can "just go" and seek the answer while the students' curiosity is fresh. Rural communities are prime learning environments for relevant and spontaneous science education (Avery, 2013) that helps "children orient to phenomena and design challenges that are of interest to them and

connect to the needs and goals of their communities" (NASEM, 2022, p. 95)

The outdoor classroom is not only an ideal place for learning about science, but it is also a site for civic advocacy (Gruenwald, 2003). Given the visibility of teachers and students within rural communities, there is an added layer of accountability within those settings that is not necessarily apparent in more populous contexts (Goodpaster et al., 2012). Judy's students are active and authentic members of the local scientific community, wearing their lab coats and Big Hole River Ambassador hats as they showcase their learning, meet with policymakers, and inspire local, regional, national, and global change. Similarly, Judy sees herself as responsible for leadership of local action and stewardship of area resources. Others see her this way as well, from school board members, to forest service workers who call her the "forest fairy" for her efforts to encourage care of area campgrounds and public forests, to state and national educators who recognized her with national awards and both state and national leadership positions.

For Judy and her students, "stepping outside of the classroom" clearly ties to the ecological and political dimensions of Gruenewald's (2003) place-conscious pedagogy, particularly when Judy engages her students in field studies such as the Big Hole Watershed Project. The watershed project is a perfect example of what NASEM (2022) describes as "opportunities to engage in meaningful scientific work within communities that position [children] as competent knowers and doers of science" (p. 70). Gruenewald explains that the ecological dimension is intrinsically tied to social and political aspects of place, such as those unique to specific families and communities. This understanding further demonstrates the potential to shift thinking about rural places as deficient to places filled with assets. While taking learning outside of the school can be powerful in

all contexts—rural, urban, suburban, and exurban—Judy's story illuminates the unique potential for rural contexts to serve as powerful sites for rigorous science education.

Step Outside of the K-8 Teacher's Comfort Zone

Great rural science teachers and multigrade educators engage in ongoing self-reflection and professional development to keep learning and pushing themselves out of their comfort zones. This is important because there may not be colleagues immediately available to support and challenge them in ways more common within larger school districts (Lovalley, 2018). Judy's synthesis of vulnerability, humility, and passion sustain her teaching and learning mindset year after year, even in a geographically isolated context. Judy sees her networking with community members, educators from beyond the community, scientists and experts, and her own students as a way to confront the myth of educator isolation in her setting. Judy's willingness to be professionally vulnerable and her enthusiasm for her own life-long learning also makes it easy for her to model risk-taking and tolerance for adversity with her students. She often proclaims, "I don't know the answer, but we can find out together." She also recognizes the importance of holding high expectations both for her students and for herself as a learner. Embracing those high expectations means "stepping out of the comfort zone" every day.

Judy acknowledged that finding and participating in professional development takes energy and time, and she noted the importance of becoming comfortable with one's own lack of knowledge. She explained how early in her teaching, she was intimidated by secondary science teachers, and while she recognized her science content and pedagogy was lacking, she hesitated to reach out to them. She realized she wasn't going to learn and improve unless she sought mentoring and new opportunities, such as when she said,

"Okay, Judy, you're gonna suck it up, cuz you're stepping out of your science comfort zone," and attended a science workshop with secondary teachers. The secondary teachers were "so excited" and welcoming, and Judy realized she didn't need to be afraid of them.

The theme "stepping out of the K-8 teacher's comfort zone" offers insight to the potential for rural place-conscious education to challenge perceptual and sociological conventions (Gruenewald, 2003). Early on, Judy held misconceptions about rural education that are common throughout society, especially in terms of rural elementary science education. As a rural teacher, Judy did not initially view herself as a scientist or science educator. In fact, she was intimidated by science professors and high school science teachers. Similarly, she perceived rural teachers as isolated and resource-scarce. While these perceptions can be true, Judy recognized she had the agency to change them. In her case, she chose to admit her limited content expertise and seek out networks of educators and experts from beyond her community and grade level.

Step Outside of Science Silos

The institution and culture of teaching has long cultivated and reinforced ideas about the need to separate science from other subjects. Secondary educators are typically prepared to teach content in silos. Even elementary teachers, who often teach multiple subjects, may not have obvious opportunities to teach through interdisciplinary lenses, since subjects other than math and literacy may not be integrated regularly into the school day. However, Judy's story demonstrates that rural teachers potentially have greater autonomy than non-rural teachers in terms of what to teach, when to teach it, and how to teach it. As a result, rural teachers are not necessarily bound by conventional views of science as a discrete subject, or of science teaching as distinct from broader elementary

pedagogy.

Central to Judy's identity is her belief that place-conscious science can be a lens to learning across disciplines, content, and grade levels, particularly in terms of real world applications. She explained, "if we're not teaching students about our world, we're not teaching. And that's where science should be forefront in everything we do, we should use it to teach literature, we should use it to teach history." Numerous studies have reported the benefits of integrating science and literacy instruction on students' reading and writing abilities (Cervetti et al., 2012; Fang & Wei, 2010; Valeras et al., 2006), mathematics achievement (Paprzycki et al., 2017), and motivation (Guthrie et al., 2009). Elementary teachers utilizing cross-curricular connections have reported that their students grasp concepts more quickly and are able to recall, transfer, and express knowledge in different ways (Brand & Triplett, 2012). Further, NASEM (2022) reports that integrating across subjects has the potential to increase the amount of instructional time spent on science, expand children's ideas of what constitutes science, and improve achievement, representation, and identification with science and engineering.

Within the rural context, interdisciplinary teaching and learning is vital, since rural teachers "wear many hats" (Petrone & Wynhoff Olsen, 2021, p. xii). Judy's use of science notebooks offers a model for strategic synthesis of learning across time and content. As older students revisit earlier unit topics, they are encouraged to refer to their multi-year science notebooks to review their earlier questions and engage in metacognition about their development across grade levels and subjects. Judy notes the innate curiosity that is especially potent within young children, who she describes as "our best scientists… then we put them in a school setting and we blow it." Central to the

effectiveness of using science as an interdisciplinary and multigrade lens is the importance of having fun. Judy's students radiate the same passion she has for learning, the outdoors, and science. They come to school in order to have fun and to learn. One kindergartner shared, "I love my science," as she hugged her science notebook tightly.

Judy's recognition of the many assets of her rural community and students disrupts deficit ideologies applied to rural contexts. As her teaching demonstrates, rural place-conscious education that transcends disciplinary borders challenges ideological assumptions about science as a distinct field framed by western or Eurocentric views (Gruenewald, 2003). Within her rural science teaching, Judy emphasizes interdisciplinary connections and consistently honors Indigenous and other place-conscious knowledges. Instead of viewing science content as siloed, she understands it is inherent and integrated all around her and her students. As she proclaims, when it comes to teaching science in rural contexts, "The World is ours!"

Implications: Learning from Judy's Portrait to Enhance Rural Science Education Research

This article addresses both our primary purpose of expanding knowledge about rural science teacher identity development and a secondary purpose of providing insights into the ways portraiture can uniquely deepen understandings of how rural teacher identities are formed, understood, and communicated. Our study illuminated one central theme–Step Outside–and three subthemes (Step Outside of the Rural Classroom, Step Outside of the K-8 Teacher's Comfort Zone, and Step Outside of Science Silos) that have shaped Judy's identity as an exceptional rural K-8 science educator. While these findings offer important implications for understanding teacher identity, we recognize that the

process of portraiture helped uncover these findings in unique ways that deepen understanding of research that investigates teacher identity. In this section, we examine the intersections between what we learned about Judy's identity development (i.e., the "Step Outside" subthemes) and how we accessed those understandings (i.e., through portraiture).

Rural Contexts: Portraiture as a Process to Step Outside Classrooms

When applied within a rural setting, portraiture can powerfully inform place-conscious pedagogy and theory, especially given its attention to *context* (Lawrence-Lightfoot & Davis, 1997). In the case of this study, a portrait of Judy's teaching not only offers a narrative of successful elementary science teaching broadly, but a "counternarrative of place" that embeds rurality within the portrait and the experiences of the co-researchers (Butler & Sinclair, 2020, p. 83). In her development of her teaching identity, Judy realized the need to "Step Outside," since explains, "learning and science is outdoors," especially given the connections between rural communities, land, field-based inquiry, and Indigenous experiences. Rural education scholars also note these connections as distinguishing rural places from urban, suburban, and exurban sites (Dayle John & Ford, 2017; Gruenewald, 2003; RedCorn, et al., 2022). In viewing these connections as strengths, rather than deficits, rural contexts become vast and exciting settings for science education research.

Judy's portrait illustrates the importance of a metaphorical "stepping out" of the classroom to engage in science education research in rural contexts and demonstrates the physical challenges of such "stepping out." Since engaging with students in the outdoors is central to Judy's identity as a rural science teacher, she wears layers of technical

clothing and prepares for all kinds of weather conditions. Given portraiture's focus on context, we learned that portraitists also need to be prepared to engage in research and learning that takes place beyond the four walls of a classroom. In addition to "wearing many [metaphorical] hats," portraitists might need to wear *real* hats, and gloves, and boots to access rural outdoor learning contexts. As we learned, rural education researchers likely will need extended travel time to reach remote schools. Put broadly, science education scholars who conduct research in rural settings need to recognize that science teaching, learning, and research can look very different in these contexts.

Rural Relationships: Portraiture as a Process to Step Outside Researcher Comfort Zones

Portraiture offers practical guidance in terms of engaging in participatory research processes, especially given its attention to the *relationships* (Lawrence-Lightfoot & Davis, 1997), collaboration, conversation, humility, and continued learning valued within many rural communities (Howley & Howley, 2014). As Becky noted in a collaborative sense-making session, Judy has created a "sense of larger community" throughout her teaching (and her learning). Both teachers and researchers can experience greater cohesion and effectiveness if they engage in long-term collaboration with members of the same rural community (Hamm, 2014; Petrone & Wynhoff Olsen, 2021), and portraiture's focus on relationship-building and collaborative sense-making can support this work. Within rural contexts, such collaboration is vital for building and sustaining trust, especially when researchers are community outsiders (Hamm, 2017; Henderson & Lennon, 2014).

For Judy, "stepping outside" means recognizing her own continued learning,

limitations, and vulnerabilities, and–in turn–acknowledging the expertise of others. The story of Judy's journey illustrates how her conscious decision to leave her "comfort zone" and engage in relationship-building became a turning point in her career and identity formation. For example, Judy's journey to the Big Hole Watershed project was the result of local conversations and relationship building that spanned several years. When she came to the community in 2002, Judy recognized that outdoor-based science teaching in her new, unfamiliar context would depend upon developing networks with community members and industry professionals, and that building trust as an "outsider" takes time (Goodpaster et al., 2012). She explains that great teachers "step out of their comfort zone" and reach out to "teaching partners" who can provide specialized mentoring and expertise, through both supporting the teacher's own learning and guiding student research in the field.

For many researchers, singular control over methodological decision-making is part of our "comfort zone." As illustrated through this study, stepping "outside our comfort zone" presents opportunities to learn, particularly about marginalized people, experiences, and contexts. Unfortunately, academic researchers can reinforce deficit thinking about rural communities and students simply by imposing our "research footprint" (Kvalsund & Hargreaves, 2014, p. 43) upon a rural community, instead of engaging in conversation with and learning from rural partners. Portraiture, like other participatory approaches, requires such decision-making to be shared between researchers and participants (Lawrence-Lightfoot & Davies, 1997). In the case of this study, our collaborative sense-making sessions were integral to understanding the "critical events" that shaped Judy's identity. Without this relational step in the process, we would not have

been able to see into Judy's past, or her present thinking about her past.

Rural Voice: Portraiture as a Process to Step Outside Research Silos

Given its attention to voice, portraiture offers an educational research methodology to reposition educators as experts in telling their own complex stories of identity development (Lawrence-Lightfoot & Davis, 1997). We know that teacher identity development is fluid, multifaceted, and contextualized, and we also know that deep investigations of the life-long experiences that have shaped teacher identities are vital for better understanding of science teaching (Avraamidou, 2014a; Avraamidou, 2014b; Wenger et al., 2012). Portraiture, and similar in-depth narrative methodologies, offer potential for educational researchers to gain new, deeper insights into the complex ways teachers change over their careers (Beijaard et al., 2004).

Judy's portrait encourages teachers and researchers to "step outside of science silos." Through the story of her professional journey, Judy shared her awareness of science as the "lens" through which all other content areas can be viewed. She also noted her shift in thinking about science as "siloed" in terms of grade level teaching and learning. Thinking about family and community in inclusive terms is reflected in Judy's view of her multigrade students. While she may have only one or two students per grade level, and several grades with no students, Judy doesn't confine the students to these specific grade levels. Instead, she sees her students as a "family unit." This sense of family is further reinforced as she works with the same students year after year, as well as the siblings and cousins of those students.

Similarly, this study helped highlight the many ways educational researchers tend to silo our approaches to doing and communicating research. We typically label ourselves

in ways that encourage such isolation and separation. For instance, we may identify as "science education researchers," as "qualitative researchers," or "urban education scholars," but we may forget to look at the fluidity and intersectionality of our identities, especially once we are engaged in a study. For Judy, effective rural teaching means developing and embracing an identity that transcends boundaries. Additionally, effective rural education researchers recognize "process as outcome" in rural research (Hamm, 2014, p. 88). Portraiture, as a participatory methodology, invites researchers to step outside predetermined research design in order to engage with participants in processes of listening, learning, interpreting, and communicating complex life stories that are themselves interdisciplinary, fluid, and dynamic.

Conclusion: "The World is Ours!"

To learn about both rural science teaching identity development and the potential for portraiture as a process to uncover unique understandings about rural science teaching identity development, this study integrated place-conscious pedagogy (Gruenewald, 2003) with conceptual and empirical features of K-8 science teacher identity development (Avraamidou, 2014a) as situated within rural contexts. Judy's stories about becoming a rural science teacher allowed us to better understand how the three themes (Step Outside of the Rural Classroom, Step Outside of the K-8 Teacher's Comfort Zone, and Step Outside of Science Silos) emerging through this study all point to the importance of viewing community and place, especially in rural contexts, as strengths-filled instead of deficient, backwards, and isolated. Through Judy's approach to teaching in her rural, multigrade school, students are scientists who are not only capable of solving "important problems," but who are the best equipped to solve those problems within their

specific communities.

Similarly, within science educational research, portraiture methodology offers opportunities to center the rural communities that have been overwhelmingly marginalized within the research. Such participatory methodologies "reposition" (Hamm, 2017; Henderson & Lennon, 2014; Petrone & Wynhoff Olsen, 2021) community members and academic researchers to as Judy says, "solve important problems" grounded in local relevance. In particular, portraiture and other participatory narrative approaches (i.e., storied-identity (Ibourk et al., 2022), Indigenous storywork (Archibald & Parent, 2019)) offer the potential to advance "critical place inquiry" (Tuck & McKenzie, 2015) and "counternarratives of place" (Butler & Sinclair, 2020) within educational research broadly, and within rural educational research specifically. As Quigley et al. (2015) explain, portraiture within science educational research can serve "as a counter-point to the dominant culture in which methods and tools were influenced by a positivist paradigm" (p. 22). Throughout this study, Judy emphasized that teaching science within a rural school means "the World is ours"—it is filled with teaching, learning, and research opportunities, if we only know where and how to look.

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