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Voices from the Classroom: Identifying Animal Science Professional Development Needs of Early-Career Agricultural Educators Who Teach Predominately Minority Students in Low-Income Schools

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Abstract

Many early-career educators report a lack of confidence in teaching animal science and suggest that comprehensive professional development would improve their abilities to engage diverse audiences in animal science instruction. This lack of confidence in providing quality instruction in key agricultural education areas could leave some educators vulnerable to attrition. Furthermore, educators who teach in low-income schools and schools with high populations of minorities are at a higher risk of attrition. Guided by the Human Capital Theory, this study aimed to assess the animal science professional development needs of early-career educators who teach predominantly minority students in low-income schools. The population for this study was New Mexico agricultural educators participating in a year-long animal science professional development cohort. This cohort was selected from applicants based on their demonstrated need for animal science professional development. The research objective was evaluated using two focus groups, which were asked about the challenges they experienced when teaching animal science. The results suggested that the participants struggle to teach complex animal science topics such as genetics, reproduction, and carcass/live animal evaluation due to a lack of knowledge, cultural challenges, and difficulty engaging students in the curriculum. We intend to use the results of this study to inform the cohort's year-long experience and suggest expanding professional development options to educators. We recommend evaluating the current professional development offered to agricultural educators to ensure it meets their needs. We also recommend conducting quantitative and qualitative studies to further evaluate educators' challenges when teaching animal science.

Review of Literature

Teacher attrition is one of the most significant challenges affecting school-based agricultural education's (SBAEs) impact on students (Lemons et al., 2015; Smith & Smalley, 2018; Solomonson et al., 2021; Solomonson & Retallick, 2018; Sorensen et al., 2016). Smith et al. (2023) reported that approximately 839 agricultural educators left the profession during the 2022-2023 school year, with educators often leaving for other employment opportunities such as teaching other content areas, school administration, production agriculture, extension, or industry. While teacher attrition is a significant threat to agricultural education's impact, Eck and Edwards (2019) report that there has been a shortage of SBAE

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teachers since the introduction of the Smith-Hughes Act in 1917. Unfortunately, approximately 41% of educators leave the profession in their first five years of service (Ingersoll et al., 2014). Solomonson et al. (2018) found that a lack of confidence in teaching the curriculum was one of the major factors driving agricultural educators out of the profession. Wood et al. (2024) determined that content-specific pedagogical content knowledge and curriculum development were two of educators' top professional development needs. Additionally, Smalley et al. (2019) suggested that motivating students to learn, determining the content that should be taught in a course, and developing curriculum in various areas were agricultural educators' top professional development needs. While attrition is an issue in SBAE, teacher efficacy is one of the primary sources of job satisfaction, and agricultural educators possess a high level of effectiveness, they often report low levels of teacher efficacy regarding student engagement (Epps & Foor, 2015).

While agricultural educators often report curriculum development (Smalley et al., 2019) and pedagogical content knowledge (Wood et al., 2024) as some areas of professional concern, Norris et al. (2023) determined that developing curriculum in animal science was one of the most challenging areas of instructional development for early-career teachers. Slusher et al. (2011) and Wells et al. (2023) evaluated the technical skills in animal science that agricultural educators need to be successful, including knowledge in animal handling, animal selection/evaluation, animal business management, animal health, animal nutrition, policy, food safety, animal reproduction, animal genetics, and tools/machinery used in the animal production industry. Yopp et al. (2020) found that Georgia agricultural educators needed professional development in animal nutrition, evaluation, diseases, reproduction, and genetics. While these animal science technical skills have a heavy focus on science, technology, engineering, and mathematics (STEM; Swafford, 2018), Norris and Roberts-Hill (2024) determined that many agricultural educators feel unconfident in their ability to implement STEM into their animal science curriculum. This is concerning since Norris et al. (2024) found that CTE administrators often play a significant role in the viability of an SBAE program, and they find STEM integration into the animal science curriculum critical for agricultural education to remain relevant.

While understanding these topics is critical to an educator's success in the animal science classroom (Slusher et al., 2011; Wells et al., 2023; Yopp et al., 2020), developing the curriculum and professional teaching strategies to teach these topics to secondary-level students is an area of professional concern (Sampson, 2024). Sampson (2024) found that many recent graduates from agricultural teacher preparation programs were unsatisfied with their pedagogical content knowledge in animal science and felt unconfident in their abilities to implement it into their instruction. Additionally, Sampson (2024) found that many recent teacher preparation graduates felt there could have been improvements to their preparation to teach animal science. Breeding et al. (2018) found that high-achieving early-career agricultural educators felt confident in their ability to teach animal science. Sampson (2024) also found that many early-career educators who were confident in their abilities to teach animal science regarded their personal experiences in animal science as their primary source of knowledge. While recent teacher preparation graduates felt unprepared in some aspects of the profession, alternatively certified educators also face many challenges (Bowling & Ball, 2018). Duncan and Ricketts (2008) suggested that alternatively certified educators exhibit less self-efficacy in technical agriculture knowledge than their traditionally certified peers, which could further exacerbate issues experienced teaching animal science.

While many educators have difficulty teaching animal science (Sampson, 2024; Yopp et al., 2020), many also have difficulty managing supervised agricultural experience (SAE) projects (Norris et al., 2023; Stair et al., 2019). This is a concern considering animal-based SAE are the most common type of project (Hanagriff, 2023), and youth engaged in livestock production can be beneficial (Evans et al., 2019; Mott et al., 2022; Ricketts et al., 2011). Evans et al. (2019) found that youth engaged in livestock production learn valuable employability skills such as financial management and leadership skills. Additionally, Ricketts et

al. (2011) suggested that students involved in livestock production learn valuable life skills such as responsibility, goal setting, flexibility, and problem-solving.

The difficulties many educators experience providing quality agricultural instruction can be exacerbated by teaching in low-income schools with high minority populations (Jayaratne et al., 2019; Simon & Johnson, 2015). Djonko-Moore (2015) noted the high rates of attrition for educators in low-income schools with large minority populations, while Simon and Johnson proposed various solutions to this phenomenon. While agricultural educators often have a passion for student success, they can face challenges in recruiting and engaging minorities in agricultural education (Jayaratne et al., 2019). Velez et al. (2018) suggested that minority groups are not often engaged in agricultural education leadership positions, and Lawrence et al. (2013) determined that the average FFA chapter engages minorities in a lower amount than Caucasian students.

Comprehensive professional development is the most commonly suggested remedy for educators who do not feel confident teaching animal science in the classroom or through SAE (Norris et al., 2023; Stair et al., 2019). Educators are often driven by student success (Solomonson et al., 2021) and are passionate about providing quality instruction (Solomonson et al., 2021). If professional development targeted to the educator's needs can be provided, it could improve educator confidence and ultimately improve teacher retention.

Purpose and Objectives

This study aimed to assess early-career SBAE educators' challenges in teaching animal science to predominately minority students in low-income schools. The following research objective was evaluated:

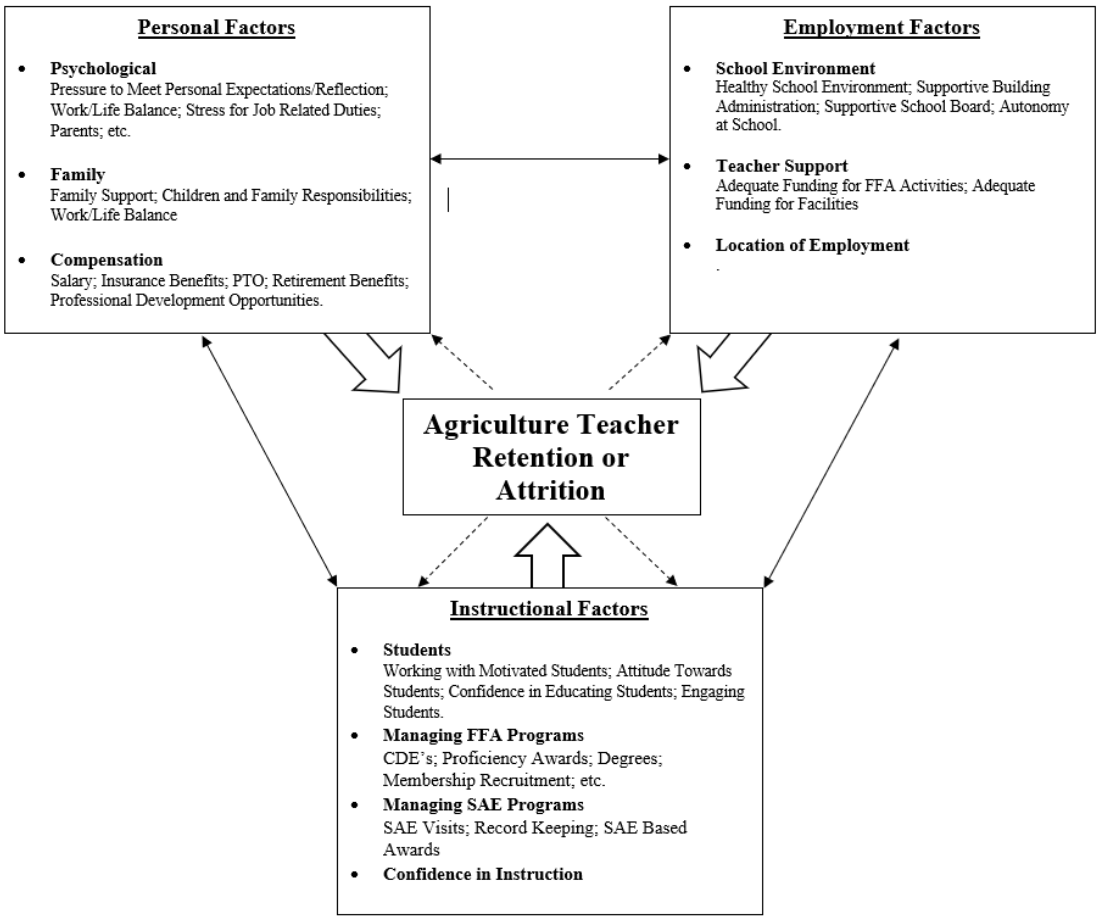
1.) Describe early-career SBAE educators' challenges in teaching animal science to predominantly minority students in low-income schools.

Theoretical Framework

The human capital theory guided this study's theoretical framework (Becker, 1993). The human capital theory describes how specialized training, education, and experience can improve an individual's confidence in their career (Becker, 1993). Many agricultural educators report a lack of confidence in teaching animal science effectively (Norris et al., 2023; Stair et al., 2019). Additionally, educators who teach low-income minority students are at a higher risk of attrition (Simon & Johnson, 2015) and often have difficulty engaging this diverse audience in SBAE (Jayaratne et al., 2019). Schmidt et al. (2022) found that many agricultural educators develop Secondary Traumatic Stress (STS) from teaching and supporting students with trauma, which is more common among minority and low-income students (Felitti et al., 1998; Swedo et al., 2023). This combination of a lack of confidence to teach animal science (Norris et al., 2023; Stair et al., 2019), combined with engaging minority and low-income students in the curriculum (Jayaratne et al., 2019), could be a source of stress to this subset of agricultural educators (Schmidt et al., 2022) and could put them at a higher risk of attrition (Simon & Johnson, 2015). An effective educator is one of the leading indicators of student success (Eck et al., 2019; Eck et al., 2020; Eck et al., 2021; Rosenshine & Furst, 1971). McKim et al. (2018) found that students of agricultural education have significantly higher rates of high school graduation and that each Carnegie unit of agricultural education completed results in an increase of $1,851 in annual income for high school graduates. This result from McKim et al. (2018) suggests that agricultural education can be highly beneficial to students, but external factors affecting low-income and minority students' agricultural educators could put them at risk of missing out on these benefits. If targeted professional development can be provided, it may increase teacher human capital in animal science (Becker, 1993), increase teacher confidence to effectively deliver the animal science curriculum, reduce teacher attrition, and therefore, increase student impact (see Figure 1; Norris et al., 2023; Stair et al., 2019).

Figure 1

Effect of Human Capital Theory on Early-Career Educator's Confidence to Teach Animal Science



Note. Developed based on Human Capital Theory (Becker, 1993).

Methodology

Guided by the goal of assessing early-career educators' challenges in teaching animal science to predominately minority students in low-income schools, we utilized two qualitative focus groups with nine total participants to evaluate the research objective of this study. We utilized a phenomenological case study approach (Merriam & Tisdell, 2016) and allowed the participants to share their personal challenges when teaching animal science topics, which yielded an in-depth understanding of the participants' animal science professional development needs (Cresswell & Poth, 2018).

Population

The population for this study was New Mexico early-career agricultural educators who teach animal science to predominately minority students in low-income schools. These participants were purposively selected from a list of applicants based on their demonstrated need for animal science professional development to participate in a year-long professional development cohort. The United States Department of Agriculture (USDA) National Institute for Food and Agriculture (NIFA) funded this year-long professional development cohort. The two focus groups were conducted at the beginning of the

cohort's first in-person meeting to inform the content of the year-long professional development experience. Overall, there were (f = 5) participants in the first focus group and (f = 4) participants in the second focus group. Additionally, there were (f = 4) participants who self-identified as Hispanic and (f = 5) participants who identified as white. Furthermore, all participants had less than four years of experience teaching SBAE and animal science, (f = 7) participants taught in a rural school, (f = 4) participants were male, and (f = 5) participants were female (see Table 1). Each participant was assigned a pseudonym based on Allen and Wiles' (2016) recommendation.

Table 1

Demographics of Focus Group Participants

Identifier	Years of Teaching Experience	Ethnicity	Gender	Agriculture Teacher Certification	School Description	Focus Group Round
Jon- (M1)	0.5	Hispanic	Male	Alternative	Rural	2
Mike- (M2)	3	White	Male	Traditional	Rural	2
Sam- (M3)	1	White	Male	Alternative	Rural	2
Tom (M4)	2.5	Hispanic	Male	Traditional	Suburban	1
Kate (F1)	0.5	White	Female	Alternative[1]	Rural	2
Kay (F2)	2	Hispanic	Female	Alternative[1]	Rural	1
Lola (F3)	2	White	Female	Alternative	Rural	1
Eve (F4)	3	White	Female	Alternative[1]	Urban	1
Jill (F5)	3	Hispanic	Female	Alternative	Rural	1

The participants in this study also taught predominantly minority students in low-income schools based on information reported by the National Center for Educational Statistics (see Table 2). The minority enrollment in the participants' schools ranged from 78.1% to 98.7%, and all schools had a high population (>70%) of Native American and/or Hispanic students. Furthermore, 48.6% to 100% of students in the participants' schools qualified for free and/or reduced lunch benefits, indicating they taught in a low-income school. Additionally, (f = 7) participants teach in a Title I school, providing further evidence that these participants teach in a low-income school.

Table 2

School Demographics of Focus Group Participants

Identifier	Free & Reduced Lunch %	Minority Enrollment %	Title One School
Jon- (M1)	100%	98.7%	Yes
Mike- (M2)	97.4%	78.1%	No
Sam- (M3)	100%	81.1%	Yes
Tom (M4)	99.8%	88.6%	Yes
Kate (F1)	100%	91.0%	Yes
Kay (F2)	100%	81.5%	Yes
Lola (F3)	100%	97.3%	Yes
Eve (F4)	48.6%	74.7%	No
Jill (F5)	100%	96.8%	Yes

Note. Information Reported by the National Center for Educational Statistics (NCES, 2024).

Data Collection

Guided by a naturalistic approach (Lincoln & Guba, 1985), the data for this study was collected using two qualitative focus groups with nine participants. We chose the phenomenological case study design (Merriam & Tisdell, 2016) to better understand the challenges experienced by early-career educators teaching animal science. Bryman (2016) explains that focus groups provide robust conversation through discussion, participants' questions, and arguments that cannot be captured through individual interviews. The focus groups were conducted at the beginning of the cohort's first in-person meeting of a year-long animal science professional development experience. One of the researchers served as the moderator of both focus groups. The questions asked during the focus groups are listed in Table 3.

Table 3

Focus Group Questions and Topics

Question	Animal Science Topics
• What challenges have you faced when teaching_____?	Animal Genetics Animal Reproduction Carcass Evaluation
• What types of professional development would assist in alleviating challenges when teaching_____?	Live Animal Evaluation Veterinary Science Other Animal Science Topics

Note. Both questions were asked for each animal science topic. Since focus groups are semi-structured, some follow-up questions were asked of the participants.

To reduce bias and improve validity, the moderator underwent training based on Bryman (2016) to ensure no moderator interference during the data collection. Additionally, the focus groups were recorded to assist in transcribing the interactions. Morgan et al. (1998) suggested using focus groups with fewer participants when the researchers anticipate robust conversation. We conducted two focus groups with fewer participants rather than one focus group to account for Morgan et al.'s (1998) recommendation. We also chose focus groups with fewer participants to reduce group think bias, increase data validity, and decrease the likelihood of one participant monopolizing the conversation (Bryman, 2016). We observed that no participant monopolized the conversation in either focus group and that each educator was allowed to express their opinions and perceptions openly, which resulted in thick and rich descriptions from each group. If the moderator sensed a participant had a unique perspective to contribute, a question was directed at that educator, and they were allowed to express their viewpoint.

The nature of the phenomenological case-study study design is to develop an in-depth understanding of a bounded system in which the variables of the phenomenon cannot be separated from their context (Yin, 2014). We selected this methodology due to the ultra-specific nature of the population (Merriam & Tisdell, 2016) and the bounded system of teaching animal science to minority students in low-income schools as early-career educators. This allowed us to explore the experiences of this population regarding challenges in teaching animal science.

Data Analysis

Once saturation was reached, we analyzed the data using an inductive coding process to identify overarching themes (Bryman, 2016). We employed the constant comparative method (Glaser, 1965) and utilized open and axial coding to identify subthemes. This process was followed by theoretical coding, as outlined by Charmaz (2006), to determine the central phenomena. To better represent the interactions in the

focus groups, we utilized exemplary statements to support each theme (Bryman, 2016). To bolster confirmability and trustworthiness, we triangulated the data using transcriptions, field notes, and a reflexive journal (Nowell et al., 2017). Additionally, to further reinforce trustworthiness, we conducted member checking by sending each participant a copy of the focus group transcript and asking them to review it for accuracy (Birt et al., 2016).

Limitations

While this study provides an in-depth analysis of early-career educators' challenges in teaching animal science to minority students in low-income schools, the phenomenological case study design has its limitations. This research design is not intended to produce generalizable results beyond the study's population (Bryman, 2016). Additionally, this study's narrow sample size is an additional limitation.

Results

Research Objective: Describe the Challenges Faced by Early-Career Agricultural Educators Teaching Animal Science to Minority Students in Low-Income Schools

The study evaluated early-career agricultural educators' challenges in teaching animal science to minority students in low-income schools. While some of the difficulties these educators face may not be specific to those teaching minority students in low-income schools, several are specific to a particular culture. Additionally, challenges regarding a lack of knowledge, cultural differences, and difficulties engaging students in the curriculum were identified.

Lack of Knowledge

The most commonly cited challenge among the participants was a lack of technical knowledge on various animal science topics. When discussing genetics, Sam (M3) stated, "I personally need help with it all… I think I had one genetics class in college," and Mike (M2) said, "Animal science has always been one of my favorite topics to learn and teach. I just don't feel comfort in knowing it." Some participants suggested they have a lack of knowledge in certain areas, such as when Kay (F2) stated, "I'm less comfortable with the show animal portion of [animal nutrition] because feeding an animal for show and feeding an animal for production is very different." Additionally, Eve (F4) stated, "I've seen this Pearson square thing, but I'm like ultimate low level." and Mike (M2) said, "I am not very strong on this. I don't think I've learned about animal nutrition in an educational setting since I was in high school".

An additional challenge was a lack of knowledge on how to teach certain subjects as effectively as possible. Tom (M4) stated

> I think for me, it's just a matter of trying to figure out how to plan an animal science class and what to teach and when to teach it. In the last couple of years, it has just been very rough for me as far as a teacher in my first year. I was in two completely different schools, and the curriculum was pretty much going out the window. I was just in survival mode in both of those schools last year.

This sentiment from Tom (M4) was resounded when Kay (F2) stated, "I have tons of questions about some of the best ways to teach the digestive system and hands-on labs. I hate lecture. I hate nothing but straight lecture. I want hands-on labs that we can do." Lola (F3) described challenges in her ability to engage students in the instruction when she stated, "I don't know how to engage students that are only in my animal science class because they were assigned to it. They don't really want to be there, and so something like livestock judging, I think, would be really hard to get the buy-in." Some teachers were frustrated with their

current resources, such as when Tom (M4) stated, "I purchased some curriculum… but at the same time, some of that does not work for my kids. So it's again just trying to figure out… trial and error right now and trying to keep my head above water…". Additionally, Jon (M1) was frustrated with the result of teaching genetics. Jon (M1) said, "We just finished going over [genetics], and some of them completely got it, and then some did not… Maybe it was just the way I was doing it."

Several educators also described a lack of knowledge on utilizing resources at their disposal. Jill (F5) stated, "At my school, I don't know who did it, but they ordered five dogs and five cat acupuncture models, and I don't know what to do with them." Additionally, Kate (F1) said, "I have the culture kits that I got from the extension office. I don't know how to teach it". Tom (M4) described having over $50,000 in unutilized equipment when he stated, "I have so many of these Reality Works things, but I have no idea what to do with half of them. Because I just inherited them [from the last teacher] with no context or anything…".

Cultural Challenges

Several educators (F3, F4, and M4) who participated in this study teach in schools with high Native American populations. The educators in this study described that the indigenous culture creates barriers to teaching animal science topics. For example, when discussing teaching animal reproduction, Lola (F3) stated, "I have to do a whole bunch of extra permission slips just to even mention the word reproduction because about 80% of my students are Navajo." This additional permission slip is due to cultural differences in the appropriateness of discussing sex or reproduction outside of the home. Due to this issue, Lola (F3) stated, "I have been blasting through that unit as fast as I could because I didn't want to risk lingering on something and somebody complaining to their parents about it… even though they signed the permission slip". This particular barrier in cultural differences was substantiated by Tom (M4) and Eve (F4), who also teach in schools with high Native American populations. Bennion et al. (2022) described the Navajo reservation as having one of the highest rates of food insecurity in the U.S. To further explain the level of food insecurity on the Navajo reservation, there are only fourteen grocery stores (Bennion et al., 2022) on the reservation, which is approximately the size of West Virginia. When describing teaching livestock evaluation in her courses, Lola (F3) stated, "Sorry, for a lot of them, being in a food desert and in food insecure homes for most of them, they feel like, 'yeah, I would eat it.' So, I think finding a way to make it relevant to real life would help them". Eve (F4) also described issues with using amphibians and/or reptiles as examples during instruction due to their symbolism in the Navajo culture (Lamphere, 1969).

Begay (2024) describes the academic achievement challenges Indigenous students face on the Navajo reservation. Several educators in this study described the results of these challenges, such as when Lola (F3) stated, "But my concern with the students that I have right now is that the math might be a little tough… I think making that math as simple as possible [will help]." Additionally, Eve (F4) stated, "And I mean with any of the math stuff, knowing what it is, because at our grade level, we'll have to explicitly teach it, I mean, expecting them to just do it [will not work]. It needs to be explicitly taught".

Engagement Challenges

The issue of engaging students in the curriculum was mentioned multiple times throughout the focus groups and was a resounding theme during the conversations. Mike (M2), when asked about professional development needs, stated, "I need some activities on how to incorporate it with the kids, but also keep them interested… We just did a survey at school, and my students are asking for engagement and more hands-on stuff." Mike (M2) also stated, "…the students said …get rid of anything computers we want to go back to pencil and paper". Tom (M4) expressed that he had difficulty finding a way to engage students who lack an initial interest in animal science when he stated

> So that's been my biggest struggle is trying to figure out how to teach a lot of these kids that necessarily don't want to be there, but also trying to engage with the kids that do want to be there while also trying to figure out what is the content that needs to be taught and how and when does it needs to be taught.

Multiple educators expressed difficulty engaging students in certain subjects, such as reproduction, due to the mature vocabulary. Tom (M4), when asked about the challenges of teaching animal reproduction, stated, "For me, I think it's trying to stay as serious as possible about it because the kids want to turn it into a big joke…". Additionally, Sam (M3) stated, "Finding activities to get them interacted in [animal reproduction] because… you always have those kids that say 'Haha, that's funny. You said that word'. Keeping them serious the entire time. Yes, I did use those two words, but that's biology," and Mike (M2) said, "Man, that's the toughest part [of teaching animal reproduction] is keeping them engaged and their maturity. But that's never going to change". Jill (M5) shared that administrative roadblocks cause some difficulty in providing engaging experiences when she said, "The biggest issue has been bringing in live animals. Like that's been the biggest issue just because it's like, well insurance, you have to have all this, like liability stuff, so it's even more of a pain".

While much of the conversation was about the difficulties of engaging students, Mike (M2) stated that he had great interest in his veterinary science course due to its engaging content. Mike (M2) said, "…next year, we'll probably have to offer… vet science. The kids really love that class, and every time we've taught it, we've had a great interest in it.". Several educators expressed that they have taken steps to increase the engagement level of their courses by purchasing equipment and supplies for labs and activities. Mike (M2) stated, "We actually just bought… a bunch of those animal science models from Reality Works". While the participating educators prioritized developing engaging lessons in animal science, some expressed that their budget did not meet their program's needs. Eve (F4) stated, "…Lab aids, they have a lot of great labs. They're just expensive. I looked into trying to buy us a bunch this year for plant science and animal science, and it was over eight grand." Tom (M4) shared that he often pays for supplies out of pocket when he stated "… so we're not spending so much of our own personal money on things. I think that's been an issue for me. I took a little bit of debt getting stuff for my classroom, but it's benefited the kids".

Conclusions, Discussions, and Implications

This study aimed to assess early-career educators' challenges in teaching animal science to predominately minority students in low-income schools. Two focus group sessions revealed three themes: lack of knowledge, cultural challenges, and engagement issues. The participants expressed a lack of knowledge regarding technical content, teaching specific topics, and utilizing resources at their disposal. The participants felt they needed more technical content knowledge to teach some animal science topics. These findings are supported by previous research, which has found that traditionally certified agricultural educators often report the need for content-specific professional development (Wood et al., 2024). This is further supported by Norris et al.'s (2023) findings that early-career agricultural educators find the development of the animal science curriculum to be one of the most challenging areas but one of the most impactful professional development topics. Several participants reported struggling to teach some animal science subjects using hands-on labs. Teachers' self-efficacy is often an indicator of their teaching practices and can influence agricultural educators' adoption of student-centered strategies such as inquiry-based learning (Baldock et al., 2022; Donnell & Gettinger, 2015; Thoonen et al., 2011). Furthermore, the findings within this theme support the results of Wood et al. (2024), who determined that educators may possess the content knowledge necessary to teach animal science but not the pedagogical content knowledge to effectively teach the content and dissect it into digestible topics for students. Rice and Kitchel (2015) determined that many preservice educators are unsatisfied with the quality, quantity, and transferability of their pedagogical content knowledge and feel unprepared to teach in the secondary classroom successfully.

When combined with teaching in a low-income school with minority students, these feelings of unpreparedness could be exacerbated (Simon & Johnson, 2015). The findings of this study provide some implications for the preparation of future educators, especially for developing cultural awareness when developing their curriculum.

The participating early-career agricultural educators reported struggling to navigate the cultural challenges that arise when teaching animal science. With many of the participants teaching within schools that have a high Native American population, it was discussed that Indigenous cultures can create barriers to teaching animal science topics. Several participants identified that the Navajo culture created challenges when learning topics such as animal reproduction and dissecting animals such as amphibians and reptiles. There has long been a debate over teaching science concepts in combination with indigenous knowledge (Gondwe and Longnecker, 2014). Francisco and Yamashita (2018) found that students who related traditional knowledge to scientific concepts demonstrated characteristics of scientific literacy. The agricultural education profession could benefit from developing a culturally aligned animal science curriculum that includes the traditions and beliefs of diverse student populations. Creating a more culturally inclusive curriculum could aid in making animal science more relevant to their personal experiences, increase student engagement, and alleviate cultural challenges experienced by agricultural educators teaching these students. Additionally, the academic challenges experienced by students on the Navajo reservation could be alleviated if indigenous knowledge was incorporated into the animal science curriculum, further propelling the importance of agricultural education in these niche areas.

Engaging students in the curriculum was a recurring theme, unsurprising since declining student engagement has been a topic for many years. Studies have found 25-60% of high school students are disengaged in the secondary classroom (Klem & Connell, 2004; Lee, 2012). Student engagement has been defined by the National Research Council and Institute of Medicine (2004) as a student's motivation to learn. The way classroom activities are designed can promote increased learning engagement (Wong & Liem, 2022). The participants noted that their students want more "hands-on" activities and less time spent on computers. Providing experiential learning opportunities for students is integral to agricultural education (Baker et al., 2012; Estepp & Roberts, 2011). The participants and their students are expressing a need for more experiential-based activities for their animal science classrooms. Additionally, participants expressed the need for low-cost animal science activities and models for their classrooms.

Recommendations for Future Practice

The findings from this study lead us to recommend evaluations for teacher preparation programs and to assess the professional development offerings for agricultural educators. The participating educators noted the difficulty in engaging students and providing culturally sensitive instruction to low-income minority students. We recommend providing professional development to better engage students in the animal science curriculum and increase its relevance through experiential instruction and inquiry-based learning. Furthermore, providing professional development on creating a culturally aligned curriculum could help alleviate cultural barriers. The professional development needs to include a variety of animal science topics and opportunities for participants to work on developing 'hands-on' activities that can be implemented in the classroom based on their access to materials and cultural diversity. Furthermore, growing agricultural educators' human capital (Becker, 1993) in animal science could improve teacher competence and retention. Several participating educators suggested they have resources at their disposal but are unsure how to incorporate them into their instruction. Providing training on utilizing these resources could be a cost-effective method of increasing student engagement and student-centered instruction. Additionally, ensuring that teacher preparation programs are helping preservice teachers develop strategies to engage students, create curriculum, and develop robust pedagogical content knowledge could help teachers hone their skills and ultimately increase their confidence.

Due to the number of low-income schools in New Mexico, encouraging schools to consolidate funds to invest in high-cost animal science teaching tools could increase access to these items. Many of the larger animal science simulation models are expensive, but if multiple schools combine funds, there might be an opportunity to purchase new items. This collection of teaching tools could be rotated among several schools, thereby impacting more students.

Recommendations for Future Research

The results of this study provide opportunities for additional scholarly inquiry into this phenomenon. The participants identified challenges, including a lack of knowledge, engaging students, and providing a culturally aligned animal science curriculum. While some of these challenges are unique to educators in low-income schools serving minority students, many of these challenges may be experienced by other groups of teachers. A qualitative study assessing the cultural challenges faced by educators teaching Indigenous students could provide insight into engaging these students in the animal science curriculum and how to better combat the food insecurity issues experienced on the reservation. A quantitative study evaluating the human capital of educators teaching low-income minority students compared to educators teaching other populations could provide additional insight into their recruitment and retention.

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