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Latinx Science Students' Sense of Belonging in Rural Wisconsin

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Abstract. This study explores the sense of belonging of rural middle and high school Latinx science students in Wisconsin. Between 2000 and 2015, the Latinx population was the fastest growing ethnic group in Wisconsin and increased by 95%. Yet, little is known about the experiences of these students in rural schools or their engagement in science learning. Our research contributes to addressing this knowledge gap and provides insights into Latinx student experiences relative to the science classroom and community. Our findings indicate that a primary determinant of Latinx science students' positive sense of belonging is a positive relationship with their teachers.

INTRODUCTION

The Latinx population is the largest and second fastest-growing ethnic minority group in the United States (Fuller et al., 2019). Accounting for 18.5% of the population of the country, Latinx communities are now present in all parts of the United States (U.S. Census Bureau, 2020). Between 2000 and 2015, the Latinx population in Wisconsin increased by 95%, becoming not only the fastest-growing racial/ethnic group during that period but also accounting for 46% of the total population growth in the state (Sugarman & Geary, 2018). Reflecting a national trend (Coady, 2020), the Latinx diaspora in Wisconsin has not been limited to urban areas (Lowenhaupt & Camburn, 2011). According to the Department of Public Instruction (2020), almost 9,500 of the nearly 160,000 students attending rural schools in Wisconsin are Latinx—about 1 in 5 of all students in the state.

The legal, social, and educational inequalities currently and historically faced by Latinx communities in the United States (Santiago, 2019) are reflected in Wisconsin, where poverty rates among Latinx (18.7%) are more than twice the rates of poverty among whites (8.3%) (Smeeding & Thornton, 2018). Additionally, Latinx communities in rural areas are less likely to have access to the educational resources and language supports available to Latinx communities in urban centers (Coady, 2019). For instance, multilingual students attending schools in rural areas tend to have teachers who are not trained in culturally- and linguistically-sustaining pedagogies (Parsley & Barton, 2015) and who are less likely to speak their multilingual students' native languages (Coady,

2020). Consequently, teachers serving Latinx students in rural schools report cultural differences and communication gaps with their students (Good et al., 2010; Hansen-Thomas et al., 2016).

Latinx families living in rural areas may also face other challenges, including limited access to health care, technology, employment, and high-quality education (Showalter et al., 2019; Coady, 2020). A study examining the background of new immigrant English learners found that many rural school districts were under-resourced, secluded, and unable to recruit and retain teachers trained to support English learners (Lee & Hawkins, 2015). Students from underrepresented groups also report that they feel little in common with people traditionally associated with science or science careers (Fisher et al., 2019; Pickrell, 2020). Yet, data suggest that scientific innovation benefits from teams that include people from various gender, ethnic, socioeconomic, and disciplinary backgrounds (Nielsen et al., 2017; Valentine & Collins, 2015). For the Latinx community, it is easy to see the lack of representation within science disciplines. In 2018, only 5% of life sciences PhDs and 3% of physical science PhDs were awarded to scientists who self-identified as Latinx (National Science Foundation, 2019). Moreover, mischaracterizations of rural areas as white and non-diverse have historically erased the experiences and agency of communities of color in transforming and asserting their identities in rural contexts (Crockett & Carlo, 2016; Morita-Mullaney et al., 2019; Tieken, 2014).

In this study, we explore the experiences of Latinx science students attending middle and high school in a rural Wisconsin school district by analyzing students' perspectives regarding their sense of belonging and the associated culturally sustaining pedagogical strategies within the community, school, and science classroom.

CULTURALLY SUSTAINING PEDAGOGY

Culturally Responsive Pedagogy (CRP) emerged as a response to the increasing diversity in U.S. schools and addresses the dynamic relationship among students' home, community, and school cultures (Ladson-Billings, 1995, 2014). Beyond supporting the academic achievement of multicultural students, CRP seeks to encourage students to accept and affirm their cultural identity (Ladson-Billings, 1995). CRP employs practices that focus on academic success, cultural competence, and sociopolitical consciousness (Ladson-Billings, 2014). Culturally sustaining pedagogy (CSP) evolved from CRP to consider the ever-changing and complex nature of the identities of minoritized youth (Paris & Alim, 2014). CSP-oriented lessons center around current events as they impact the lives of a community. These include cultural elements associated with African American, Latinx, and other minoritized groups (Ladson-Billings, 2014).

In science classes, CSP can help students gain a rich understanding of the academic content and how it connects to and affects their communities (Brown et al., 2019; Laughter & Adams, 2012). Centered on a desire for change, a science curriculum should foster the development of identities and relationships; allow multiple points of entry based on experiences, practices, or interest; and advance problem-solving skills focused on students' backgrounds (Barton et al., 2003). Examples for incorporating CSP in the science curriculum include using nontraditional texts; providing opportunities for students to integrate their home cultures into lessons; and sharing data, photos, and information from scientists that have the same or similar backgrounds as the students (Ganesan, 2020; Paris & Alim, 2014, 2017). There is a lack of literature in theory-to-practice research about cultural relevance in science education (Brown et al., 2019). Furthermore, a question remains as to how to prepare science teachers so that all students, including Latinx students, reach their potential in science education (National Academies of Science, Engineering, and Medicine, 2018).

SENSE OF BELONGING

A sense of belonging provides children of all ages with the identity, emotional security, relationships, and agency they need to learn and thrive in school and become a contributing member in the community (Wastell & Degotardi, 2017). Research shows that students' sense of belonging diminishes

as they enter secondary school, and this is especially true for Latinx and African American students (de Jong et al., 2020). Sense of belonging is constructed through linguistic and cultural practices performed through interactions with teachers, peers, and others (de Jong et al., 2020). Familiarity with the local environment can further support the development of a sense of belonging (de Jong et al., 2020; Gustafson, 2001; Nanzer, 2004), and organizing learning around places—including the interrelationships between people and the natural world—can promote inclusive student success (Johnson et al., 2020). Research has long shown that the lack of a sense of belonging in school for students from historically marginalized groups is linked to structural policies and practices that prioritize Eurocentric values and norms while devaluing the cultural wealth students possess (DeNicolo et al., 2017).

STUDY CONCEPTUAL FRAMEWORK

There remains an urgent need for research that studies the intersectionality of rurality and Latinx or English-learner education (Coady, 2020). To develop a curriculum based in CSP, researchers and practitioners must first understand the perceptions and relations of Latinx students relative to their school, teachers, and community. In rural Wisconsin, school districts are exploring strategies to improve their ability to respond to the needs of Latinx students and their families and to better understand both the community and educative resources that Latinx students need in order to excel in the classroom.

This study reports the voices of 13 middle and high school Latinx students attending school in rural Wisconsin. We drew from literature addressing sense of belonging among minoritized and multilingual students (de Jong et al., 2020; Hussain et al., 2018) and critical-pedagogy and ontologies of place (Gruenewald, 2003; Hawkins, 2014).

Specifically, our study explored the following research questions:

- What are the perspectives of Latinx science students regarding their sense of belonging within the rural school, community, and classroom?
- What are the similarities and differences between student perspectives about their sense of belonging and those expressed by their teachers?

RELEVANCE TO EXTENSION

This project resulted from a collaboration between the University of Wisconsin-Madison's Division of Extension and School of Education. The work is relevant to Extension professionals and programming in several ways. Importantly, it examines culturally sustaining educational strategies

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for areas relevant to Extension, including: engaging rural minoritized populations (e.g., Ramos, 2016), teaching about science topics (e.g., Bruyere & Salazar, 2010), and conducting place-based education (e.g., Francis et al., 2014). Like other Extension programs (such as Juntos 4-H), this study also explores strategies for supporting Latinx populations directly (e.g., Behnke et al., 2020; López-Cevallos et al., 2021). Sense of belonging is also a concept that can help improve our understanding of impacts and outcomes related to engagement and outreach programs (e.g., DeCubellis & Barrick, 2020), as are the sense of belonging determinants—place attachment, agency, inclusion, and relationships.

METHODOLOGY

Prior research used surveys to better understand bilingual students' sense of belonging within the classroom and community (de Jong et al., 2020). For this study, we used a cross-sectional web survey to collect data that provided a direct measure of a student's sense of belonging. We also collected data providing a direct measure of the four individual dimensions of belonging—relationships, place attachment, agency, and inclusion.

Participants in this survey were 13 Latinx science students within a rural Wisconsin school district. The students included one 6th grade student, two 7th grade students, four 8th grade students, one 9th grade student, three 10th grade students, and two 12th grade students. Nine of the students were bilingual and four spoke only English. Eleven indicated that they spoke English the best and two indicated that they spoke English and Spanish equally well. Five indicated that they “like” English the best and eight indicated that they “like” English and Spanish equally.

The survey design allowed for predicting variance in sense of belonging for Latinx students using direct measures of the independent variables of relationships, place attachment, agency, and inclusion. We then considered the variable score to be the average score of the questions designed to measure each variable. We used Likert-type questions (Boone & Boone, 2012) to measure each variable, including:

- Two questions regarding sense of belonging,
- Thirteen questions regarding relationships,
- Seven questions regarding place attachment,
- Seven questions regarding agency, and
- Thirteen questions regarding inclusion.

We also utilized a cross-sectional web survey to collect data regarding six teachers' perceptions of Latinx students' relationships, place attachment, agency, and inclusion. The surveyed teachers included five science teachers and one teacher of English Language Learners. We only analyzed

descriptive statistics for the teachers due to the relatively small sample.

All questions used a six-point, bipolar Likert rating (i.e., 1 (strongly disagree), 2 (disagree), 3 (somewhat disagree), 4 (somewhat agree), 5 (agree), and 6 (strongly agree)). We also allowed respondents to choose a response of “I don't know.”

To create the Likert scale data for Latinx students, we calculated a composite score/mean based upon the items meant to measure each variable and examined correlations among the student variables using Pearson correlation coefficients (Boone & Boone, 2012). Then, we analyzed the independent variables using stepwise regression analysis to determine which of the four—relationships, place attachment, agency, or inclusion—produce the regression model with the maximum predictive power (Montgomery & Peck, 1992). The stepwise regression identifies which variables are statistically significant predictors of student sense of belonging. Olejnik et al. (2010) found that stepwise regression was more successful in selecting a correct model than an examination of all possible regression models; however, stepwise regression is also prone to error, and a reduced sample size can increase the potential for error. Studies have suggested that 10 to 20 observations per independent variable are needed for logistical regression to minimize error concerns (Peduzzi et al., 1996). Our study has 13 observations for each variable and is within the suggested range, albeit on the low end.

The stepping method criteria for the stepwise regression used a probability value of 0.05 for entry and 0.10 for removal. We also examined the explanatory variables for potential multicollinearity problems. Because none of the independent variables had a correlation coefficient greater than 0.8, we did not determine that multicollinearity was a concern for the dataset (Table 7).

RESULTS

Table 1 shows the mean and standard deviation of the study variables. Latinx students indicated that on average, they agree that they feel accepted at school and that they belong there ($M=4.9$). Similarly, Latinx students indicated that on average, they agree that they have agency ($M=5.4$), attachment to the school and community ($M=5.1$), and supportive relationships ($M=5.2$). The lowest rated variable was inclusion ($M=4.5$). Latinx students somewhat agree to agree that they experienced or observed Latinx cultural examples within the school, science curriculum, and community on a regular basis and that Latinx culture was valued within the school and community.

Table 2 shows descriptive statistics for teacher survey data. The survey for teachers did not ask about Latinx student sense of belonging specifically, but it did include questions about their perspectives on the dimensions that support Latinx student sense of belonging. Average scores

Table 1. Descriptive Statistics for Latinx Student Study Variables

Variable	N	Mean	Standard Deviation
Sense of Belonging	13	4.9	1.00
Agency	13	5.4	0.47
Inclusion	13	4.5	0.98
Place Attachment	13	5.1	0.80
Relationships	13	5.2	0.47

Table 2. Descriptive Statistics for Teacher Study Variables

Variable	N	Mean	Standard Deviation
Agenc	6	4.7	0.43
Inclusion	6	4.5	1.00
Place Attachment	6	4.7	0.27
Relationships	6	5.0	0.75

for teachers were similar to Latinx students' scores for relationships, and teachers agreed that Latinx students have supportive relationships at school and in the community ($M=5.0$). Teachers rated place attachment ($M=4.7$) and inclusion ($M=4.5$) only slightly lower. Teachers rated agency ($M=4.7$) lower than did students, showing that teachers somewhat agree to agree, on average, that Latinx students have agency within the school and community.

We can gain additional insights by looking at the average responses by teachers and Latinx students to specific questions. The following tables show the mean responses for some of the questions that were asked of both populations.

When considering agency (Table 3), Latinx students agree to strongly agree, on average, that they can participate in community events in the same way that peers can ($M=5.6$), while teachers only somewhat agree ($M=4.0$).

Overall, teachers somewhat agree to agree that Latinx students can flexibly use Spanish or English in class ($M=4.7$; Table 4), while Latinx students somewhat disagree ($M=2.8$). Teachers were also more likely to agree ($M=5.3$) than were Latinx students ($M=4.4$) that Latinx families receive school news and communication in Spanish. On the community level, teachers rated being bilingual as valued in the community lower ($M=4.0$) than did Latinx students ($M=5.2$). Teachers also perceive that Latinx heritage is less valued in the community ($M=2.8$) than their Latinx students do ($M=5.0$), and teachers provide a lower rating of opportunities for students to share their culture and family history in the community ($M=3.0$) than Latinx students do ($M=4.4$).

On average, teachers and Latinx students agreed to strongly agreed that the school offers science learning experiences that connect to the community, and somewhat agreed to agreed that the science class has taken trips to local places in the community (Table 5).

Table 3. Teacher and Latinx Student Responses to Agency Questions

Question	Mean Latinx Student Response	Mean Teacher Response
I/my Latinx students care about doing well academically.	5.6	4.8
I/my Latinx students can participate in community events in the same way that peers can.	5.6	4.0
I/my Latinx students could pursue a career in science if I/they wanted to (for example, veterinarian, doctor, pharmacist, nurse, engineer).	5.3	5.2
I/my Latinx students have control over my/their academic success at school.	5.5	4.8
My classmates and I/Latinx students are involved in community projects.	5.0	5.0

Both teachers and Latinx students agree to strongly agree that their interactions are positive and that they feel appreciated (for teachers) and respected (for students; Table 6). When asked about having a close relationship with at least one student or teacher, students somewhat agreed that they had a close relationship with at least one teacher ($M=4.4$), and teachers agreed they had a close relationship with at least one student ($M=5.0$).

Table 7 shows the Pearson correlation coefficients for the student study variables. The variable with the strongest positive correlation with Latinx students' sense of belonging is relationships (0.57).

An examination of the maximum predictive stepwise regression model further revealed that the only variable that significantly predicted Latinx students' sense of belonging was relationships ($p = 0.04$), indicating that strong perceived relationships with teachers had a significant positive effect on student sense of belonging.

CONCLUSIONS

Relationships were a significant predictor of Latinx students' sense of belonging, and strong perceived relationships with

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Table 4. Teacher and Latinx Student Responses to Inclusion Questions

Question	Mean Latinx Student Response	Mean Teacher Response
The activities I do in class are flexible, so that I/my students can use Spanish or English to discuss, explain, write, etc.	2.8	4.7
It is valuable to teach and learn science in Spanish as well as in English.	5.3	5.0
Being bilingual is valued in the community I/my Latinx student live in.	5.2	4.0
In the community, I feel like Latino/Latina/Latinx heritage is valued.	5.0	2.8
My teachers/I value the fact that I/my student am/are bilingual.	4.6	6.0
At school, I feel like Latino/Latina/Latinx heritage is valued.	5.1	4.3
In the community, I/my Latinx students have opportunities to share about my/their culture/family history.	4.4	3.0
I/my Latinx students am/are able to attend events where Latino/Latina/Latinx heritage is celebrated.	4.6	3.3
My/my Latinx students' family receives school news and communications in Spanish.	4.4	5.3
At school, I/my Latinx students have opportunities to share about my/their culture/family history with the class.	4.4	4.2
Images/information in school materials (like textbooks) show Latino/Latina/Latinx contributions to science.	4.3	3.3
Spanish appears in science textbook or science class materials	3.9	4.5

Table 5. Teacher and Latinx Student Responses to Place Attachment Questions

Question	Mean Latinx Student Response	Mean Teacher Response
My school is involved with our community.	5.4	4.5
My school offers science learning experiences that connect to the local area and community.	5.2	5.0
My science class has taken trips to local places in the community	4.8	4.4

Table 6. Teacher and Latinx Student Responses to Relationship Questions

Question	Mean Latinx Student Response	Mean Teacher Response
The interactions I have with my teachers/students are mostly positive.	5.6	5.7
I feel respected/appreciated by my teachers/students.	5.5	4.8
I have a close relationship with at least one of my teachers/students.	4.4	5.0

Table 7. Teacher and Latinx Student Responses to Relationship Questions

	Sense of Belonging	Relationships	Place	Agency
Sense of Belonging				
Relationships	0.57			
Place	0.38	0.68		
Agency	0.32	0.57	0.55	
Inclusion	0.25	0.42	0.33	0.7

Table 8. Teacher and Latinx Student Responses to Relationship Questions

Variable	R ²	β	Significance
Relationships	0.32	1.21	0.04

teachers had a significant positive effect on student sense of belonging. Participant student responses suggested that their relationships with teachers are caring and supportive and that they feel like their teachers cared about their learning. Our study also supports the emphasis in the pre-existing literature that teacher and peer relationships are key dimensions of belonging (de Jong et al., 2020; De Nicolo et al., 2017).

Overall, teachers were more likely to rate aspects of inclusion related to the classroom higher than Latinx students and were more likely to rate aspects of inclusion related to the community lower than Latinx students. More specifically, teachers were more likely to respond that they were enacting practices connected to culturally and linguistically responsive teaching in their lessons. Alternatively, and congruent with the findings of de Jong et al. (2020), students perceived more of a monolingual atmosphere in the school. Our findings suggest that although Latinx students value the closeness of the school community, they did not always feel that their multilingualism and culture were reflected in the curriculum or school spaces.

Despite rating inclusion lowest, sense of belonging and other variables were still relatively high for Latinx students. In addition, teachers frequently perceived that students had fewer community cultural experiences than did the Latinx students. Both of these factors may indicate that Latinx students feel the need for connectedness to the local dominant culture rather than Latinx culture. Drawing from Moje et al. (2000), this may indicate that the students have become accustomed to institutionally-accepted, dominant-culture discourses and believe that this is what will provide them future success.

We acknowledge that our sample size for this research was relatively small but believe the findings of our research point to the value of additional research and inquiry within this topic area. For these reasons, it is important to interpret the findings from this research as indicators of potential insights into the factors that influence Latinx students' sense of belonging rather than as clear evidence of broader causal or predictive relationships. We believe our work is well-suited for naturalistic generalization, which occurs when data resonates with a broad cross-section of readers and can facilitate an improved understanding of the questions being explored (Feagin et al., 1991).

As a result of this study, our team has developed a professional development program for rural science teachers that is centered on culturally sustaining approaches. Both Coady (2020) and Manner & Rodriguez (2012) suggest that professional development through workshops has the potential to help rural teachers build their capacity and improve teacher preparation in rural communities. Our program has incorporated the voices of Latinx community members, and our intended outcomes include:

- Providing students with opportunities for extensive collaboration and the integration of students' cultures through culturally sustaining approaches.
- Working with Latinx communities through the lens of the complexity of Latinx identities.
- Facilitating civil discourse related to environmental topics using language supports.
- Engaging students with science and environmental knowledge as it relates to the Latinx communities and culturally sustaining pedagogies.

In closing, our study underscores the importance of acknowledging and embracing the changing demographics experienced by rural districts across the nation. Embedding culturally sustaining approaches within our science education and engagement frameworks can lead to educational environments where Latinx students both succeed academically and feel welcomed within the science classroom, school, and community. The work of Extension professionals often focuses on the importance of relationships, and our study further underscores the significance of that work in supporting a sense of belonging for minoritized populations. Additionally, our findings provide a reminder to Extension professionals and other professionals that while we may view our educational activities as inclusive, the populations we are serving may view them differently. Our work further underscores the importance of engaging with and listening to the voices of those we are serving as we build out programming efforts.

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