

## **Using a Two-Way Engagement Community- and Family-Centered Pedagogy to Prepare Pre-Service Mathematics Teachers in a Hispanic-Serving Institution**

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### **Abstract**

Research on effective methods to prepare pre-service teachers (PSTs) in teaching mathematics to K-12 Latin\* students has been gaining significant momentum. These efforts have focused, in part, on promoting pedagogical practices that recognize and incorporate the culture and language that K-12 Latin\* students and their communities share. As teacher educators, we argue that if we are to further prepare PSTs to serve the needs of such increasingly diversifying K-12 student population, the same pedagogical focus on the learner's cultural wealth should also be applied to the preparation of PSTs themselves, especially among Latin\* PSTs in Hispanic-Serving Institutions (HSI) like ours. This paper documents how a university faculty prepared a cohort of Latin\* PSTs using a Two-Way Engagement Community- and Family-Centered Pedagogy (CFCP) in a mathematics content course at an HSI. Twenty-four PSTs completed a semester-long mathematics project that involved interviewing local Latin\* business owners or managers, interacting with family leaders from the community, and presenting their projects at a local symposium. PSTs' experiences showed that the implementation of the Two-Way CFCP in the mathematics classroom not only strengthened their mathematical content and pedagogy preparation but also helped them to recognize their cultural wealth as a valuable educational resource.

*Note:* In recent years, the term Latinx has become the de facto term to denote individuals from Hispanic, Latino/a, and other similar race/ethnic groups. However, the term Latinx has also been criticized for neutralizing gender, sexual identity, language, and ethnicity rather than achieving its original goal of inclusivity (Salinas, 2020). The term Latin\* (pronounced Latin), on the contrary, “can go beyond a word; it can be used as a space holder for people to reclaim their identities in the complexity of layers of Latin American origin and descent” (Salinas, 2020, p. 164). Therefore, we opted for the term Latin\* as an attempt to represent such identity complexity.

## Discussion And Reflection Enhancement (DARE) Pre-Reading Questions

1. What are ways you have implemented (or thought about implementing) connections to the culture of the students in your school/community?
2. What are ways you have implemented (or thought about implementing) connections to the language of the students in your school/community?
3. What are ways you have implemented (or thought about implementing) connections in your teaching to your local community?

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## Using a Two-Way Engagement Community- and Family-Centered Pedagogy to Prepare Pre-Service Mathematics Teachers in a Hispanic-Serving Institution

Olga Ramirez, Mayra Ortiz Galarza, and Luis M. Fernández

Our nation's growing reliance on scientific and mathematical advances accompanied by a growing Latin\* population (Bauman & Murray, 2017) call for new, creative, and effective methods to prepare Latin\* mathematics pre-service teachers (PSTs) in ways that promote their STEM capacities while simultaneously recognizing their culture and language as valuable educational resources. Indeed, it has long been documented that tapping into the learners' funds of knowledge (Moll et al., 1992), including the shared knowledge and assets within the learners' communities and families (Anhalt et al., 2018; Civil, 2002, 2007), allow for the learning process of mathematics to become more relevant and attainable for learners, particularly among Latin\* students and other underserved populations (e.g., Celedón-Pattichis et al., 2010; González et al., 2001; Williams et al., 2020). Incorporating such community and familial knowledge and assets into teacher preparation programs has also shown to help shape PSTs' future role as facilitators that bridge their students' culture, communities, and families to classroom instruction (Kelley, 2020; Burton & Williams, 2021; Monárrez et al., 2021; Saathoff, 2015). Collectively, these efforts could have the capacity to strengthen the mathematics preparation of every cohort of Latin\* educators to come.

Such need for more culturally inclusive pedagogies is essential at universities like ours that prepare a preponderance of Latin\* PSTs who, once in the teaching profession, will also need to know how to engage with and incorporate their K-12 Latin\* students' community and familial assets into their mathematics classrooms (Gomez, Jones, & Tanck, 2020; Krause & Colegrove, 2020). However, this creates a significant challenge as many teacher preparation programs are still underprepared in training PSTs to meet the needs of our growing culturally and linguistically diverse population (Ostorga & Farruggio, 2020; Lehman, 2017; Canales-Vela, 2017), not to mention the unpreparedness shared by many universities in meeting the needs of Latin\* college students, in general (e.g., Fernández, et al., 2019; Maestas et al., 2007; Ojeda et al., 2014; Otero et al., 2007). It becomes clear, then, that if we want to address the need for better qualified and well-prepared K-12 Latin\* mathematics educators, we must continue to advocate for teacher preparation programs that build upon Latin\* PSTs' cultural assets, such as the funds of knowledge that is embedded within their communities and families.

It is worth mentioning that all three authors recognize the intersectionality that their identities have with their roles as mathematics educators. Even though they all identify as being part of the Latin\* community, they hold different insider and outsider perspectives, as well. The first author identifies as bilingual, bicultural, first college generation Latin\* woman with expertise in mathematics education, culturally relevant mathematics, and teacher preparation. The second author identifies as a bilingual, bicultural, first college generation Latin\* woman with expertise in mathematics education, STEM education, teacher preparation, and relevant experience in bilingual mathematical contexts. Lastly, the third author, who identifies as a Latin\* man, not only brings with him his expertise in the mathematics education of the Latin\* K-16 student population, but he also brings his personal experience growing up as a former English Learner (EL)-labelled student throughout his elementary education in the United States.

Through these lenses, we present our initial-experiences in adopting a Two-Way Engagement Community- and Family-Centered Pedagogy (CFCP), a developing framework where universities engage families and businesses from the community as partners and recognize their capacity to contribute to the academic and professional preparation of its Latin\* PSTs. As such, we implemented a Two-Way Engagement CFCP with 24 Latin\* PSTs enrolled in a mathematics content course at a Hispanic-Serving Institution's (HSI's) teacher preparation program with the intentions of strengthening the PSTs' mathematical proficiency and, ultimately, to inform educational policies in ways that enable more robust teacher preparation programs.

## Developing the Two-Way Engagement CFCP

Throughout the years, there has been a gradual shift in how we think about the education of underserved populations (Denton et al., 2020). Rather than focusing solely on the challenges and disadvantages underserved students face, this shift calls for the adoption of an asset-based perspective that recognizes them as possessors of cultural capital (Yosso, 2005). Thus, it is by engaging with, and learning from, such students' funds of knowledge that an array of knowledge, skills, and abilities exist and that, when incorporated into the education of underserved populations, not only lead to higher academic achievements but are even powerful enough to be used against macro- and micro-forms of oppression (Freire, 1973).

Efforts of integrating students' funds of knowledge into teacher preparation programs underscore its significance in promoting equity, inclusivity, and academic success among underserved students, including the PSTs themselves. This approach involves recognizing and incorporating the diverse backgrounds, experiences, and knowledge that students bring from their homes and communities into the teaching practice. It is through efforts like these that teacher preparation programs can continue to further develop culturally competent educators who can effectively connect curriculum content with their future students' lived experiences, especially when their future students come from culturally and linguistically diverse backgrounds (e.g., Espinoza, Nuñez, & Degollado, 2021; Johnson & Newcomer, 2020; Stoehr & Civil, 2022; Williams et al., 2020). Stoehr and Civil (2022), for example, explored how PSTs' interactions with Latina mothers from the local community helped them to think of ways to make meaningful connections between the students' home experiences and their future mathematics teaching practices. These PSTs also developed an awareness of the importance of building relationships with their future students' families, as well as recognizing the expertise that was shared by the Latina mothers that often gets overlooked in academic settings.

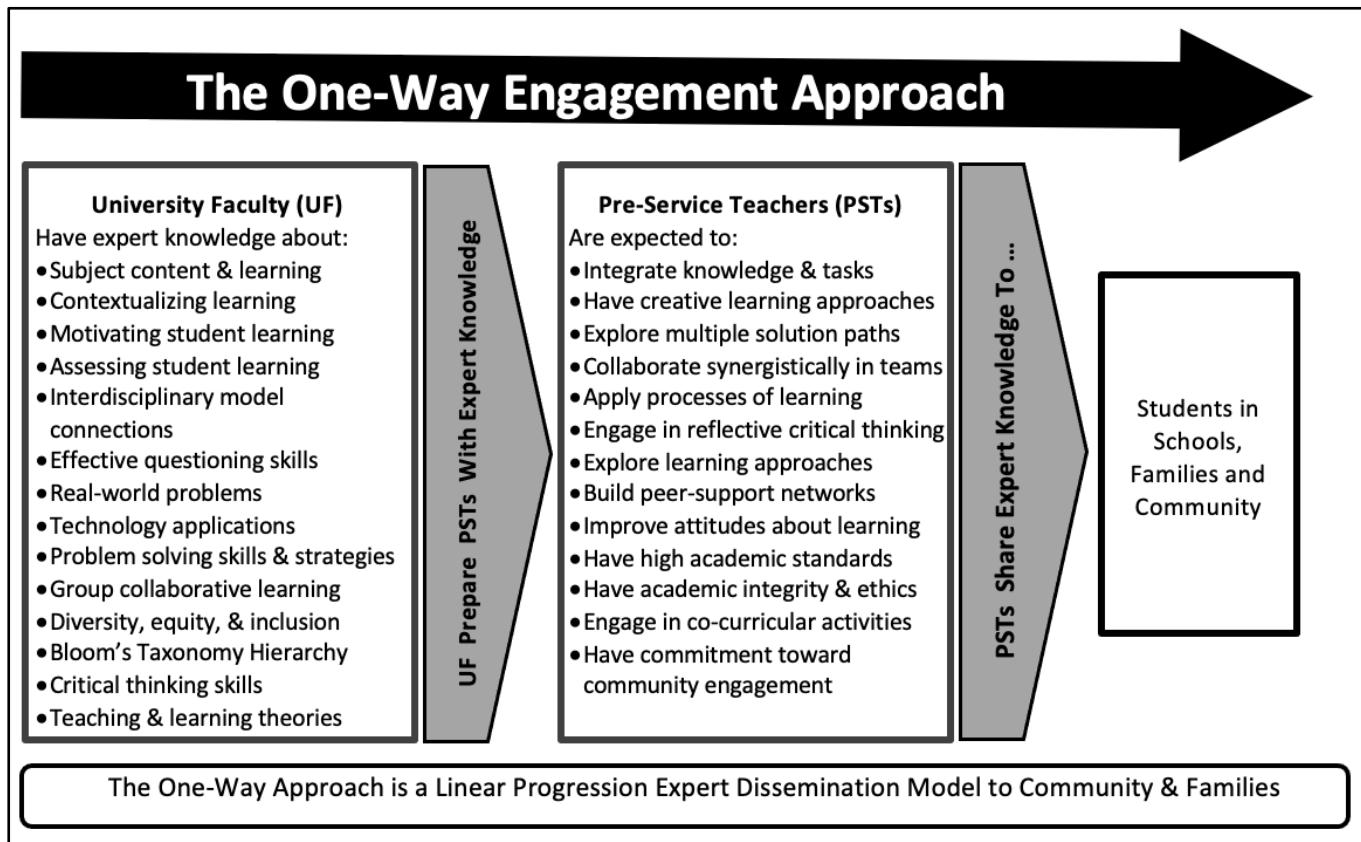
In a similar note, Espinoza and colleagues (2021) tasked a group of bilingual (English – Spanish) PSTs with creating lesson plans that supported and sustained their students' "communities' cultural practices and ways of being" (p. 5). In that study, PSTs were conducting an internship experience with actual students and were asked to visit their local community establishments, such as a *restaurante* and *panadería*, speak to community leaders and members, and collect artifacts, all in an effort to create genuine community-based lessons for their students. As a result, the PSTs experienced a deeper awareness and connection to their students and their communities which translated to a higher engagement and participation during the teaching of such lessons. Furthermore, the PSTs recognized the community members as possessors and creators of knowledge, and therefore "disrupting the privileging of the school's official standards-based curriculum that traditionally ignores local resources" (p. 10). Such studies serve to highlight the engagement efforts that are required between teacher preparation programs and its surrounding communities to gain a deeper understanding of the community's cultural assets.

On the other hand, Grains and colleagues (2019) raise awareness to potential issues embedded within community engagement efforts, particularly on those where their tendency is to adopt a unidirectional, or One-Way Engagement Approach, in which the parties of power tend to be the main benefactors from such interactions. This is typically employed by universities delivering knowledge and expertise primarily to rather than also from the public sector (Roper & Hirth, 2005; Weerts & Sandmann, 2008).

As seen in Figure 1, the One-Way Engagement Approach positions university faculty as the knowledge authorities who either 1) share expertise with communities or 2) will prepare PSTs with specific expert knowledge that they will then share with their future students, community, and families. As a result, the One-Way Engagement Approach can be described as a linear progression dissemination model with expert knowledge that goes solely from university experts (faculty and prepared students) to community and family members.

**Figure 1**

*The One-Way Engagement Approach (composed by Ramirez and Ortiz)*

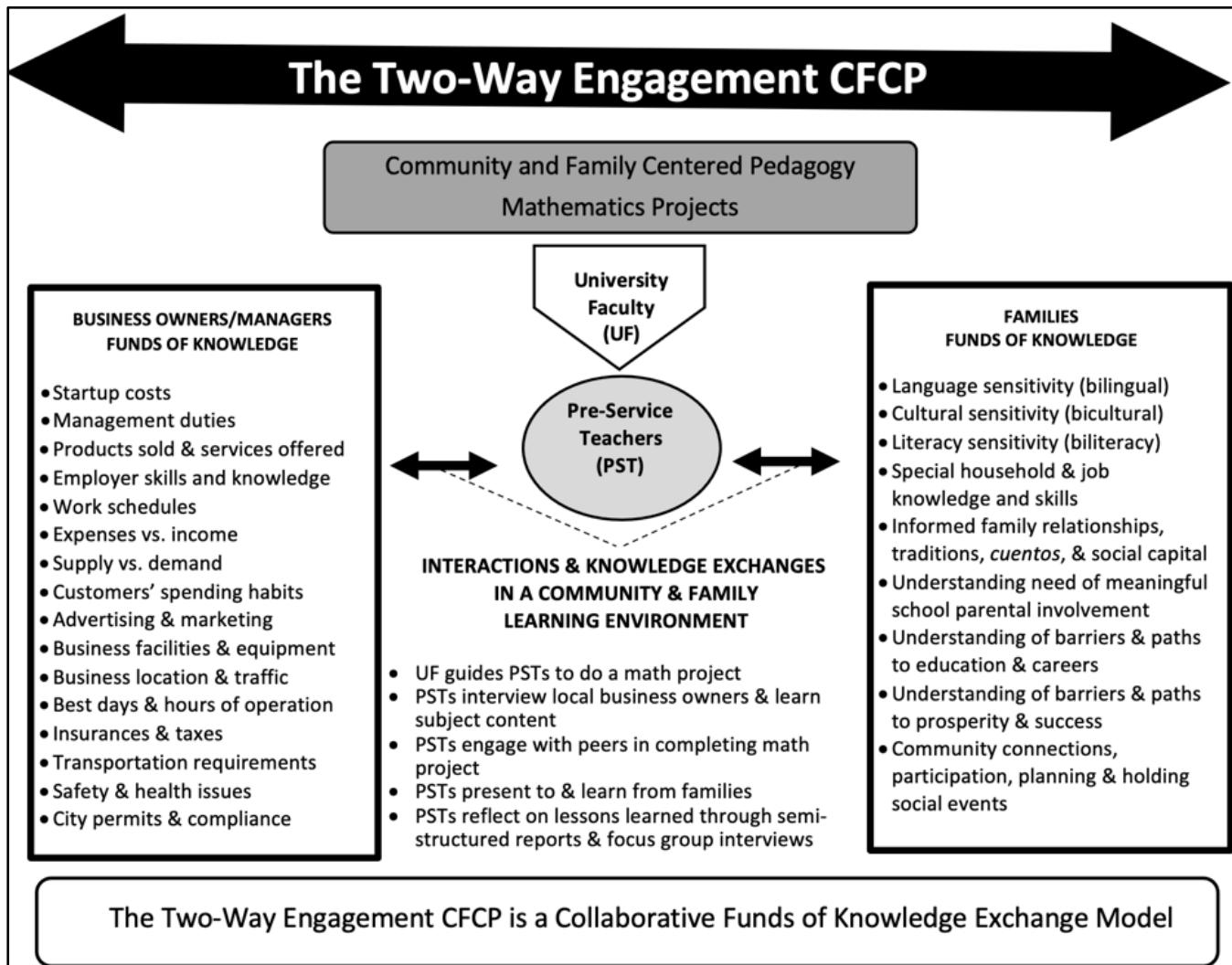


In order to create a more equitable learning environment for *all* parties involved, we adopted a Two-Way Engagement CFCP (see Figure 2), a developing framework that values, incorporates, and reciprocates the funds of knowledge generated by community partners in the preparation of Latin\* PSTs. There were two types of community partners working with our PSTs. One group consisted of the business owners (volunteers) whom our PSTs selected to interview based on the business they chose to study, and the second group consisted of Latin\* (mainly Spanish-speaking) family leaders from the community that partner with our university to expand community and family engagement, inclusive of family-centered pedagogy. The Two-Way Engagement CFCP was designed to engage with these two groups from the local community.

Furthermore, the Two-Way Engagement CFCP recognizes the cultural and cognitive resources that exist within the PSTs' communities and families as funds of knowledge with a great potential utility for classroom mathematics instruction (Moll et al., 1992). In other words, the Two-Way Engagement CFCP is a collaborative model in which all members are recognized as valid sources of knowledge, including the PSTs' families and community partners (Fitzgerald et al., 2012; Weerts & Sandmann, 2008). Furthermore, business owners, students' family members, family leaders from the community, university faculty, and PSTs exchange and gain knowledge from these valid sources. This engagement model allows for knowledge to adopt a bidirectional nature, growing and evolving as it goes from one member to another within the university-community-family context (Boyer, 1996).

**Figure 2**

*The Two-Way Engagement CFCP (composed by Ramirez and Ortiz)*



### Using the Two-Way Engagement CFCP in a Mathematics Course

A cohort of 24 PSTs participated in this project. All PSTs identified as Mexican or Mexican-American. Among them, 20 identified as female and the rest identified as males; with all but two PSTs demonstrating various degrees of bilingualism in English and Spanish. Approximately 70% of the participants were also identified as first-generation college students from low socio-economic backgrounds. They were all enrolled in a foundational mathematics content course designed for students seeking general teacher certification, that is students pursuing a teaching degree at the elementary level. Additionally, the topics taught in this course did not deviate from the already-established curriculum, including set theory, numeration systems, and the development of special number sets with an emphasis on problem solving and the use of manipulatives.

The biggest challenge encountered by the course instructor during the implementation of the CFCP in the mathematics course was finding how to keep the PSTs on task with the weekly project assignments. To address this, first, the PSTs were placed in groups depending on their mathematics project focus to help and support each other. Forming the groups turned out to be very beneficial for the PSTs who needed more direction. By helping each other, the PSTs would input their individual work on a OneDrive folder that was accessible to the group and to a graduate

assistant that offered them help, along with the course instructor. This facilitated dialogue about the projects within the groups and helped keep the students on task. The course instructor and graduate assistant would review weekly the work submitted on the OneDrive folder by each group and promptly responded on whether or not they had met the week's project assignment objective.

The weekly list of assignments developed by the course instructor and a mathematics education colleague included having each student: (1) Choose a business; (2) Write a justification for why this business is important to the community and families; (3) Conduct research on historical and current events about the selected math business topic; (4) Submit at least five questions, with answers, based on the history or current events regarding the selected math business topic; (5) Create a list of twelve or more open-ended questions applicable and related to the specific business that you will use to interview the business owner/manager; (6) Make an appointment to interview the business owner/manager; (7) Interview the business owner or manager, in English, Spanish, or both languages; (8) Summarize, organize, and analyze data from the interview of the business owner/manager; (9) Complete a tri-fold poster to present the math project to family leaders; business owner/manager can be invited; (10) Create at least five math questions, with answers, related to the selected business; (11) On the tri-fold poster, include some interview questions, history and math questions, and specific findings about the business; (12) Do a presentation to community and family leaders who will engage with you & provide feedback, in English, Spanish, or both languages; (13) Improve the tri-fold poster by incorporating feedback; (14) Present the revised and improved math project in a symposium, three weeks later; (15) Complete a semi-structured report including lessons learned from doing the community and family-centered math project with recommendation for future research; (16) Attend and participate in focus groups with questions about this math project. This weekly list of assignments used to operationalize the mathematics project proved to be effective in keeping the students on task and in having them work in support groups. It also reduced the time needed to explain the mathematics project during class because the PSTs became fully aware of what to do each week. For their semester-long project, the PSTs were asked to use the Two-Way Engagement CFCP to research, study, learn, apply, and connect the mathematics embedded in Latin\* local businesses to the mathematics topics discussed in class. Furthermore, PSTs were expected to work closely with family leaders from the community through classroom visits in the development of their mathematics projects, discussed in detail in the following section. Overall, the mathematics project counted for 20% of the course grade.

### **Adopting the Two-Way Engagement CFCP for the PSTs' Mathematics Projects**

Based on the Two-Way Engagement CFCP, the PSTs were assigned to interview (sometimes in Spanish) local Latin\* business owners or managers to understand the history and mathematical connections related to their business. For this, the course instructor provided PSTs with sample interview questions and other guidelines that supported the interviewing processes. Then the PSTs developed their interview protocols that included questions about the history of the selected business, history of the business sector or product, and mathematical connections to the business selected. Artifacts, pictures, and other math-related information were also collected from the businesses by the PSTs as part of their assignments. There were nine overarching types of businesses (i.e., *tamalerías*, snack shops, *pizzerías*, *panaderías*, *taquerías*, nail and hair salons, *carnicerías*, and real estate agencies) that PSTs included in their projects. All businesses were either owned or managed by Mexican or Mexican-American community members. Figure 3 illustrates some sample projects, interview questions, history questions, and mathematics questions.

Additionally, visits to the mathematics classroom were scheduled for the PSTs to interact with the aforementioned Latin\* family leaders from the community. Approximately 20 family leaders visited the mathematics classroom three weeks prior to the end of the semester where they engaged with the PSTs over their "nearly completed" mathematics projects. The family leaders participated in discussions with the PSTs over their presentations and the content on their projects' tri-fold posters. During this visit, family leaders provided feedback to the PSTs on how to improve their mathematics' projects from a family perspective which the PSTs would present once again three weeks later at a

symposium to a larger audience. Notably, the family leaders reciprocated their own funds of knowledge about the mathematical topics at hand by sharing their at-home knowledge and perspectives, including their knowledge on the Latin\* culture, language(s), and informed traditions, as well as special household and job skills (Moll et al., 2001). As an effect, the family leaders not only served as an audience for the PSTs to practice their presentations with, but they also adopted an important role in which they shared practical knowledge and skills with cultural and Spanish language connections that they shared with the PSTs.

**Figure 3**

*Two-Way Engagement CFCP PSTs' Sample Mathematics Projects*

	<p><b>Delia's Tamales</b>  <b>PST Comment:</b> I wanted to focus on the success of this business because it is fascinating how a small Mexican-American business owner that started from a small, at home, business is slowly branching out throughout some regions of Texas.</p>	
<p><b>Sample Interview Questions</b></p> <p>A. How did the idea of opening your business come to mind?      B. How is mathematics related to your business?      C. What are some of your expenses?</p>		
	<p><b>Nana's Taquería</b>  <b>PST Comment:</b> Nana's Taquería brings Mexico's culture and atmosphere experience to the United States. Nana's Taquería has been recognized as one of the "120 Tacos you must eat before you die" in Texas.</p>	
<p><b>Sample History Question [Correct Answer is A]</b>      Tacos originated in Mexico. How did they come to the United States?</p> <p>A. Tacos came through migrants that traveled to Los Angeles in the early 1900s      B. In the early 1900s the Aztecs were able to cross tacos into the United States.      C. In the early 1900s the Spaniards were able to cross tacos into United States.</p>		
	<p><b>Natalie's Beauticity Nail Salon</b>  <b>PST Comment:</b> I discovered Natalie's amazing nail art two years ago and ever since she is the only one I let work on my nails. This business serves the RGV community and families and it is a self-operated bilingual business within Natalie's own home.</p>	
<p><b>Sample Mathematical Question [Correct Answer is D]</b>      How much money can be made per month if overall expenses cost a total of \$2,000 monthly and this business does 100 sets of nails monthly priced at \$45 each?</p> <p>A. \$1500    B. \$2220    C. \$2000    D. \$2500</p>		
	<p><b>Aguilar's Meat Market</b>  <b>PST Comment:</b> Aguilars Meat Market is a family-owned meat market that started from humble beginnings and now has expanded to various parts of the Rio Grande Valley. They have made a name for themselves as one of the best meat markets in the Rio Grande Valley.</p>	
<p><b>Sample Mathematical Question [Correct Answer is B]</b>      If Aguilars need to buy a bandsaw for \$10,000 and Fajitas (a type of meat) costs \$10 per pound. How many pounds of Fajitas does Aguilars's Meat Market need to sell to be able to purchase a bandsaw?</p> <p>A. 900    B.1000    C.1200</p>		

The mathematics project experience culminated at the end of the semester with the PSTs presenting their mathematics projects at a symposium. It was during this education- and community-oriented event where the PSTs showcased their finalized mathematics projects to approximately 150 attendees, including some members of the students' own families, families from the community, mathematics and science students, graduate research assistants, faculty, and university administrators. For this final stage, all PSTs were encouraged to speak English, Spanish, or both languages with the intentions of not only facilitating communication among all attendees, but to also empower the PSTs' usage of linguistic practices that are typically not valued in academia.

### **A Sample Two-Way Engagement CFCP Mathematics Project**

As part of the project assignments, PST Emma selected “Delia’s Tamales,” a Latin\* family-owned chain of restaurants specializing in *tamales*. For this, Emma had to approach the business manager to introduce herself, state the purpose for her visit, and to secure a collaborative agreement for an interview. Simultaneously, as part of the project requirements, Emma developed a semi-structured interview protocol based on course expectations. The protocol included questions in three different categories: 1) History of the business sector/product; 2) History of the selected business; and 3) Mathematical connections to the business selected. The development of the interview protocol was comprised of multiple stages, such as brainstorming several questions for each category, refining the questions through peer-collaboration and discussion, selecting the most appropriate questions for the interview, and preparing follow up questions. Additionally, as part of the interview preparations, Emma organized the logistics to conduct a successful interview (i.e., learning how to build rapport, preparing the interview protocols, practicing interview rehearsals in advance, getting her equipment and materials ready for the interview, etc.). Emma’s investigation not only highlighted important facts about tamales and their role in Mexican or Mexican-American family traditions, but also culturally relevant mathematical connections embedded to the business about tamales.

### **Presenting the Mathematics Projects in a Local Symposium**

Participating in the end-of-semester symposium represented an opportunity for Emma and other PSTs to connect with their community. Emma not only presented the connections between mathematics and Delia’s Tamales but also described important connections of this business with the culture and language of her Latin\* community. Conducting a mathematics project guided by the Two-Way Engagement CFCP empowered Emma and other PSTs to gain confidence and abilities. For example, because of her interactions with a business manager and the families from the community, Emma reported that she lost her fear of public speaking, improved her written and oral communication skills, and that she even lost her fear of mathematics, realizing that mathematics is everywhere and that it is a way of life with interesting and meaningful culturally relevant applications. Furthermore, she valued the interactions with the family leaders and the feedback given to her. She stated that the mathematics project was a very interesting experience and she, as well as her current classroom peers, highly recommended that her peers in future classes do this mathematics project. As a result, Emma’s adoption of the Two-Way Engagement CFCP culminated in an intricate collection, and flow, of funds of knowledge that highlighted the content and cultural wealth that lies within her community (see Figure 4).

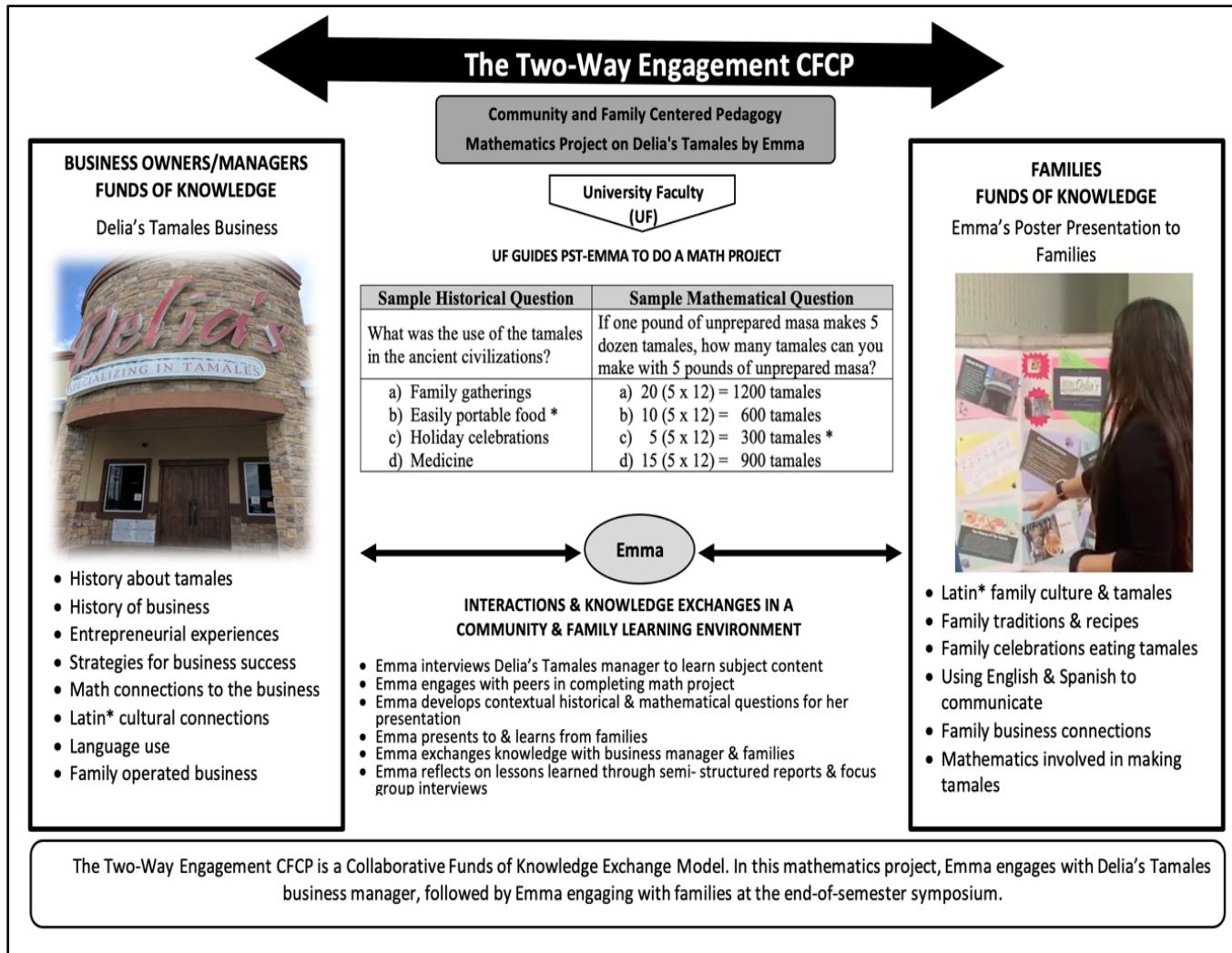
### **Takeaways of Conducting a Mathematics Project Using the Two-Way Engagement CFCP**

Preparing a new generation of PSTs that will effectively impact their communities calls for a more holistic curriculum where PSTs should not only master the course content but also develop productive mathematical identities with the set of skills that will help them understand, connect, and better serve their students and communities (Gibbons et al., 2018). Even though a full empirical study is beyond the scope of this paper, we still believe it is worth sharing evidence of PSTs’ identity development. In the next section, we share their perspectives about the mathematics

project derived from participating, at the end of the semester, in focus groups led by another mathematics educator that was not the instructor and by submitting written reflections. The three overall themes that emerged from the focus groups are summarized in what follows.

**Figure 4**

*Emma's Adoption of the Two-Way Engagement CFCP for Her Math Project*



### Preparing Better Mathematics PSTs via the Two-Way Engagement CFCP

A notable impact described by the PSTs in this Two-Way Engagement CFCP mathematics project was that they truly felt encouraged and mentored by their professor to engage with the local community, something no other professor was doing or has done in their classes. For instance, Julia shared that “Dr. [M] has been the only professor to care about my development as a math student by conducting this project and allowing us to become more involved [with the community].” Similarly, Miriam pointed out that “while I don't think all my professors encouraged me to connect with local families, the fundamentals of mathematics class staff did encourage me... [They] cared about how I developed as a math student.”

Similarly, participants referenced and appreciated the professor’s efforts to support the PSTs throughout the project. Ana said that “... definitely Dr. [M] was there to help us and cared about us.” At the same time, PSTs were also introduced to educational research where they learned to extract, summarize, and organize the most important

data and ideas. They also stated that they had improved their oral, written, social, and organizational communication skills. For instance, as Brianna said “... I really enjoyed doing the poster, interviewing, and researching on bakeries because I was able to practice my oral, researching, and presenting skills. I’m glad we were given the project.” Other PSTs also mentioned that they learned how to connect real life mathematical applications to the businesses they interviewed and researched. They admitted that it was the first time they had to create mathematics problems with solutions for a mathematics project (rather than selecting them from a textbook), but that it was not difficult to do because there were ample ways of connecting mathematics to the business products, prices, recipes, measurements, taxes, giving change, etc. The PSTs stated that this experience caused them to realize that they can do similar history and mathematics projects with their future students, and that they became more open-minded to the unlimited connections they can share with their future students about mathematical applications.

This led to PSTs realizing the importance of connecting with their communities and families, especially because they will be teachers who will need to do this as part of their profession (Gibbons et al., 2018). As noted by Daniel, “Doing a math project for families is important because we get to experience in meeting the future parents of our students.” The PSTs also reported on having learned many different academic, historical, communication, and mathematical ideas that will help them both as students in other courses, as well as in their teaching careers. They admitted that having learned how to conduct research on their own will help them to do research for their classes when they become teachers, and they mentioned that they would also have their students do similar mathematics projects.

### **Connecting Mathematics with a Local Business via the Two-Way Engagement CFCP**

In order to address the mathematics connections to the selected businesses, PSTs had to investigate and make sense of the specialized knowledge required to understand how mathematics affects the business finances and operations. Therefore, when presenting their projects to the families and other attendants at the symposium, PSTs addressed the funds of knowledge and intellectual capital wealth business owners possess. This led to many PSTs seeing the important connections and applications of mathematics to different businesses, something they had never thought about before. As stated by Fernanda, “It was a nice experience. I learned a lot about my community and about business[es], also about how math is applied in the business.” Likewise, Whitney mentioned that she “was also able to see how mathematics is used in local businesses which is something [she] never thought of doing.” In a similar note, Alissa pointed out that “math is essential in everyone’s daily life, but especially in businesses. It is the foundation on which they built their business and continue to keep running. They are used in calculating things like expenses and profits.”

As a result, not only did the PSTs appreciate the mathematics embedded within typical businesses, but they also had the opportunity to learn about what it takes to establish a business and to develop empathy and appreciation for their communities. For instance, when completing and presenting their mathematics projects, the PSTs proudly mentioned their appreciation for the Latin\* culture, the work ethic of the owners, and what the businesses offered to their communities. As mentioned by Jessica, “The businesses contribute to our community by expanding the economy, giving us family-oriented places, and by showing people that anything can be done despite the challenges.” PSTs admired the hard work, dedication, and passion the business owners had for their businesses, employees, products, and services, and they valued their personal stories about how they got started. For example, Daniel pointed out that business owners “can succeed in business if they dedicate themselves 100% with hard work.” PSTs recognized not only how unusual it is for mathematics college students to conduct research about a business; but also, for business owners to collaborate with and feel appreciated by mathematics college students. As stated by Raquel, “Not many people know what it takes to start a business so by doing research and presenting the business, I know I gave them a sense of pride in their work. The business owner feels more valued.”

## Connecting with Families via the Two-Way Engagement CFCP

Being able to connect with families from their communities by conducting a Two-Way Engagement CFCP mathematics project represented an unusual yet meaningful experience for PSTs. For instance, when involved in interactions with the family leaders from the community partner, the PSTs were very complimentary of them because the families truly showed interest in their mathematics projects and in their deep commitment to pre-K to university education and to their community. As mentioned by Miguel, “[The families] spoke to us about the importance of doing this project. How it really brings the community together and how it will help us in the future. They made me feel proud that I finished the project.” In addition, Alissa said that “doing the math project for families is important because it demonstrates the appreciation that we have not only for them but for the community.”

The PSTs appreciated and incorporated the community partners’ feedback to improve their projects as much as possible, and they admitted that interacting with family leaders from the community also prepared them to communicate with parents like those of their future students by learning about their backgrounds, language, culture, and interests. For instance, Ana mentioned that interacting with the families “will help me interact with the parents later on when I become a teacher on my ways of socializing more, … so both of us can work as a team and help the student.”

Another important note is that for those PSTs that plan to stay in their communities, it is very critical to understand their community and families to better serve their students. As described by Jessica, “It is important with my career because I plan to live and work here so understanding how families here work and think helps me with communication in my career.”

In terms of language, some PSTs admitted to feeling proud to speak their own native language, Spanish, in their communications with the families. However, they realized that to better serve their communities, some of them need to work on their Spanish. For instance, Raquel mentioned that “Communicating with families allows me to prepare myself to communicate with parents. It has made me realize that I need to work more on my Spanish, especially because I may have parents or students that only communicate in Spanish.”

## Discussion, Implications, and Recommendations

There is a wealth of literature delineating the advantages of connecting students’ funds of knowledge to their academic growth (González et al., 2006; Kelley, 2020; Monárrez et al., 2021; Saathoff, 2015; Williams et al., 2020). We argue that this must also include engaging Latin\* PSTs with their communities, local leaders, and families as a means to further develop support programs at HSIs that are culturally relevant (Herrera & Sánchez, 2022). Because of this, the Two-Way Engagement CFCP was implemented in a mathematics content course serving Latin\* PSTs. This allowed for the creation of a learning environment in which all PSTs completed assignments designed to guide them through self-reflections for them to recognize and value their community’s linguistic and cultural wealth in context with their mathematics projects while simultaneously enhancing their overall mathematics proficiency. The Two-Way Engagement CFCP led to an empowerment of PSTs that translated to a stronger understanding of the role that mathematics plays within their community and themselves, especially as future educators of Latin\* bilingual and bicultural students like themselves. The participants’ voices help us to confirm that creating opportunities where PSTs can connect to their communities is beneficial for both the university and the members of the community.

Recognizing and appreciating the knowledge and contributions of local businesses and families positively impacts the professional preparation of PSTs. Furthermore, awareness of the implementation of the Two-Way Engagement CFCP project is creating interest from faculty participants and University administrators to consider proposing enhanced educational policies that reward faculty that embed CFCP in their mathematics courses. Therefore, we ask scholars to continue developing their efforts to enhance the mathematics preparation of Latin\* PSTs and other underserved student populations. Further studies should also explore the effects that a Two-Way Engagement CFCP has on Latin\* PSTs’ mathematical and cultural identity development and how this is reflected in

their mastery of the mathematical content that they are supposed to teach. Lastly, it is worth investigating if there is an enactment of the Two-Way Engagement CFCP, or other similar pedagogies, by PSTs once they have completed their teacher preparation program and have begun teaching.

## References

Anhalt, C. O., Staats, S., Cortez, R., & Civil, M. (2018). Mathematical modeling and culturally relevant pedagogy. In Y. J. Dori, Z. R. Mevarech, & R. Baker (Eds.), *Cognition, metacognition, and culture in STEM education: Learning, teaching and assessment* (pp. 307-330). Springer.

Bauman, H. D., & Murray, J. J. (2017). Sign languages. In O. García, N. Flores, & M. Spotti (Eds.), *Handbook of language and society* (pp. 243-260). Oxford University Press.

Boyer, E. L. (1996). The scholarship of engagement. *Journal of Higher Education Outreach and Engagement*, 1(1), 11-20.

Burton, M., & Williams, G. (2021). Helping preservice teachers connect to students, subject, and self. *Teaching for Excellence and Equity in Mathematics*, 12(2), 25-32.

Canales-Vela, V. (2017). *Exploring Bilingual Teachers' Beliefs about Academic Language Development in Mathematics Teaching: Implications for Bilingual Teachers' Professional Development*. [Doctoral dissertation, The University of Texas Rio Grande Valley]. ProQuest Dissertations & Theses Global.

Celedón-Pattichis, S., Musanti, S. I., & Marshall, M. E. (2010). Bilingual elementary teachers' reflections on using students' native language and culture to teach mathematics. In M. Q. Foote (Ed.), *Mathematics teaching and learning in K-12* (pp. 7-24). Palgrave Macmillan.

Civil, M. (2002). Culture and mathematics: A community approach. *Journal of Intercultural Studies*, 23(2), 133-148.

Civil, M. (2007). Building on community knowledge: An avenue to equity in mathematics education. In N. Nasir & P. Cobb (Eds.), *Improving access to mathematics: Diversity and equity in the classroom* (pp. 105-117). Teachers College Press.

Denton, M., Borrego, M., & Boklage, A. (2020). Community cultural wealth in science, technology, engineering, and mathematics education: A systematic review. *Journal of Engineering Education*, 109(3), 556-580.

Espinoza, K., Nuñez, I., & Degollado, E. D. (2021). "This is what my kids see every day": Bilingual pre-service teachers embracing funds of knowledge through border thinking pedagogy. *Journal of Language, Identity & Education*, 20(1), 4-17.

Fernández, L. M., Wang, X., Ramirez, O., & Villalobos, M. C. (2019). Latinx students' mathematics anxiety and their study habits: Exploring their relationship at the postsecondary level. *Journal of Hispanic Higher Education*, 20(3), 278-296.

Fitzgerald, H. E., Bruns, K., Sonka, S. T., Furco, A., & Swanson, L. (2012). The centrality of engagement in higher education. *Journal of Higher Education Outreach and Engagement*, 16(3), 7-28.

Freire, P. (1973). *Pedagogy of the oppressed*. Continuum.

Gibbons, L., Feldman, Z., Chapin, S., Batista, L. N., Starks, R., & Vazquez-Aguilar, M. (2018). Facilitation practices in mathematics teacher education and the mathematical identities of preservice elementary teachers. *Mathematics Teacher Education and Development*, 20(3), 20-40.

Gomez, C. N., Jones, S. R., & Tanck, H. (2020). Preparing bilingual pre-service teachers to foster equitable and open communication with Latinx immigrant parents *en la enseñanza de matemáticas*. *Teaching for Excellence and Equity in Mathematics*, 11(3), 41-49.

González, N., Andrade, R., Civil, M., & Moll, L. (2001). Bridging funds of distributed knowledge: Creating zones of practices in mathematics. *Journal of Education for Students Placed at Risk*, 6(1-2), 115-132.

González, N., Moll, L. C., & Amanti, C. (2006). *Funds of knowledge: Theorizing practices in households, communities, and classrooms*. Routledge.

González, N., Moll, L. C., Tenery, M. F., Rivera, A., Rendon, P., Gonzales, R., & Amanti, C. (1995). Funds of knowledge for teaching in Latino households. *Urban Education*, 29(4), 443-470.

Grain, K., Katumba, T., Kirumira, D., Nakasiita, R., Nakayenga, S., Nankya, E., ... & Ssegawa, M. (2019). Co-constructing knowledge in Uganda: host community conceptions of relationships in international service-learning. *Journal of Experiential Education*, 42(1), 22-36.

Herrera, F., & Kovats Sánchez, G. (2022). Curando la comunidad [healing the community]: Community-centered STEM identity. *Journal of Hispanic Higher Education*, 21(2), 135-150.

Johnson, E. J., & Newcomer, S. N. (2020). Funds of knowledge mentors: Partnering with Latinx youth to incite dispositional shifts in teacher preparation. *Journal of Latinos and Education*, 19(4), 368-382.

Kelley, T. L. (2020). Examining pre-service elementary mathematics teacher perceptions of parent engagement through a funds of knowledge lens. *Teaching and Teacher Education*, 91(1), 1-14.

Krause, G. H., & Colegrove, K. S. S. (2020). "Whenever my mom speaks Spanish at home, it helps me understand more in math": Reflections on the testimonios of bilingual Latinx students. *Teaching for Excellence and Equity in Mathematics*, 11(2), 43-51.

Lehman, C. L. (2017). Multicultural competence: A literature review supporting focused training for preservice teachers teaching diverse students. *Journal of Education and Practice*, 8(10), 109-116.

Maestas, R., Vaquera, G. S., & Muñoz Zehr, L. (2007). Factors impacting sense of belonging at a Hispanic-Serving Institution. *Journal of Hispanic Higher Education*, 6(3), 237-256.

Moll, L. C., Amanti, C., Neff, D., & González, N. (1992). Funds of knowledge for teaching: Using a qualitative approach to connect homes and classrooms. *Theory into practice*, 31(2), 132-141.

Monárez, A., Wagler, A., & Wagler, R. (2021). Latinx STEM teacher formation through a cultural wealth lens. *Journal of Hispanic Higher Education*, 20(2), 164-178.

Ojeda, L., Castillo, L. G., Meza, R. R., & Pina-Watson, B. (2014). Mexican Americans in higher education: Cultural adaptation and marginalization as predictors of college persistence intentions and life satisfaction. *Journal of Hispanic Higher Education*, 13(1), 3-14.

Ostorga, A. N., & Farruggio, P. (2020). Preparing bilingual teachers on the US/Mexico border: Including the voices of emergent bilinguals. *International Journal of Bilingual Education and Bilingualism*, 23(10), 1225-1237.

Otero, R., Rivas, O., & Rivera, R. (2007). Predicting persistence of Hispanic students in their 1st year of college. *Journal of Hispanic Higher Education*, 6(2), 163-173.

Roper, C. D., & Hirth, M. A. (2005). A history of change in the third mission of higher education: The evolution of one-way service to interactive engagement. *Journal of Higher Education Outreach and Engagement*, 10(3), 3-21.

Saathoff, S. D. (2015). Funds of knowledge and community cultural wealth: Exploring how pre-service teachers can work effectively with Mexican and Mexican American students. *Critical Questions in Education*, 6(1), 30-40.

Salinas, C., Jr. (2020). The complexity of the "x" in Latinx: How Latinx/a/o students relate to, identify with, and understand the term Latinx. *Journal of Hispanic Higher Education*, 19(2), 149-168.

Stoehr, K. J., & Civil, M. (2022). Conversations between preservice teachers and Latina mothers: An avenue to transformative mathematics teaching. *Journal of Latinos and Education*, 21(4), 366-378.

Weerts, D. J., & Sandmann, L. R. (2008). Building a two-way street: Challenges and opportunities for community engagement at research universities. *The Review of Higher Education*, 32(1), 73-106.

Williams, J. J., Tunks, J., González-Carriedo, R., Faulkenberry, E., & Middlemiss, W. (2020). Supporting mathematics understanding through funds of knowledge. *Urban Education*, 55(3), 476-502.

Yosso, T. J. (2005). Whose culture has capital? A critical race theory discussion of community cultural wealth. *Race, Ethnicity and Education*, 8(1), 69-91.

### **Discussion And Reflection Enhancement (DARE) Post-Reading Questions**

1. What do you see as the biggest benefits or reasons for applying focus on learners' cultural wealth to the preparation of PSTs themselves? What is a challenge and how might you address it?
2. What is the main difference between a one-way and a two-way approach to engagement and why does that matter?
3. Describe any examples of a two-way approach you have seen in your community.
4. Collaborate with a fellow local educator to brainstorm a list of local business owners that might be wonderful for PSTs to interview. Reflect on your process or criteria for whom you selected.