

Family-Centered Theory of Change: A Conceptual Framework for Improving Teaching and Learning in Undergraduate STEM Courses

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Abstract

Hispanic-Serving Institutions (HSIs) are often characterized as Hispanic enrolling (rather than serving) that practice deficit-based systems that continue to marginalize Latinx and other underrepresented students, especially in STEM fields. Extant research on HSIs stresses the importance of investigating the value of grassroots advocacy groups as external influencers of institutional servingness through deeper engagement with the Latinx community. Using a novel family-centered theory of change that addresses diversity, equity, and inclusion, we integrated intersectionality and servingness into a family-integrated education serving and transforming academic framework. We investigated the potential transformational impact of this framework on students, families, faculty, and administrators at The University of Texas Rio Grande Valley, an institution with over 90 % Latinx population, the majority of which are Mexican American. Preliminary findings shed light on how the framework can help reshape an HSI's identity from "Hispanic enrolling" to a true Hispanic-Serving Institution through Family-Centered Pedagogy.

The Family-Centered Pedagogy enriches the learning experience in which students complement their instruction by drawing from their families' experience and ancestral knowledge, supported by the Family-Centered Theory of Change developed by AVE Frontera, our community partner.

Keywords: family-centered education, theory of change, pedagogy, institutional transformation, HSI, Latinx, STEM education, community partnership

Conflict of Interest: Dr. Juan Salinas has a potential conflict of interest due to a financial interest with AVE Frontera. A management plan has been created to preserve objectivity in research in accordance with UTRGV policy.

Resumen

Las Instituciones de Servicio Hispano (HSI por sus siglas en inglés) se caracterizan normalmente por inscribir (en lugar de servir) a las Latinas y practican sistemas basados en el déficit que continúan marginalizando a las Latinas y otros estudiantes subrepresentados, especialmente en ciencia, tecnología, ingeniería, y matemáticas (STEM por sus siglas en inglés). La investigación existente sobre los HSI subraya la importancia de investigar el valor de organizaciones de abogacía como influyentes externos de promoción del servicio institucional a través de un involucramiento más profundo con la comunidad latina. Usando la nueva Teoría de Cambio Centrada en la Familia que toca los temas de diversidad, equidad, e inclusividad, integramos interseccionalidad y servicio dentro de un marco del programa Familia Integrada a la Educación que Sirve y Transforma la Academia. Investigamos el impacto potencial de transformación de este programa en estudiantes, familias, profesores, y administradores de The University of Texas Rio Grande Valley, una HSI con una población latina de más del 90 %, de la cual la mayoría son Mexicanos Americanos. Los resultados preliminares sugieren que el programa tiene el potencial de cambiar la identidad HSI de “inscribir” a verdaderamente “servir” a las Latinas a través de la implementación de la Pedagogía Centrada en la Familia. La Pedagogía Centrada en la Familia se define como el enriquecimiento de la experiencia de aprendizaje en la cual el estudiante complementa su propia instrucción haciendo uso de la experiencia y conocimiento ancestral de sus familias, apoyados por la Teoría de Cambio Centrada en la Familia desarrollada en AVE Frontera, nuestro socio comunitario.

Palabras clave: educación centrada en la familia, teoría de cambio, pedagogía, transformación institucional, HSI, latine, educación en STEM, sociedades con la comunidad

Introduction

Historically, institutions of higher education have failed to construct systems, governance structures, and policies that better serve Latinx students and their families, who have also endured political, social, and demographic challenges for greater access to U. S. higher education (MacDonald, Botti, & Clarck, 2007). From the 1840s to the mid-1950s, Mexican Americans were subject to overt oppression and discrimination (Allsup, 1982; Guajardo & Guajardo, 2004; Yarsinske, 2004; Blanton, 2007; Carrigan & Webb, 2013). In turn, Mexican Americans gaining equal access to quality education has been and continues to be an ongoing process since the 1950s (Ovando, 2003; Gandara, Moran, & García, 2004; MacDonald, Botti, & Clarck, 2007; Ortegon, 2013). Several legal cases clearly illustrate this: *Rodriguez v. San Antonio ISD* (1971), *Hernandez v. Texas* (1954), *Serna v. Portales Municipal Schools* (1974), and *Richards v. LULAC* (1993), among others. For decades, educational leaders and researchers have stated that higher education institutions must quickly change to face society's demands for accountability in the quality of education (Santiago, 2012; Galdeano, Flores, & Moder, 2012; American Council on Education, 1996).

The Higher Education Act of 1965, as amended in 1998, defines a “Hispanic-serving institution” (HSI) as an accredited, degree-granting, public or private nonprofit, two- or four-year institution of higher education with 25% or more total full-time undergraduate Latinx student enrollment. Galdeano, Flores, and Moder (2012) assert that “Hispanic enrolling” does not necessarily translate to “Hispanic serving.” They argue that HSIs are crucial entities for leadership in the economic and social development of Latinx communities and that their institutional culture should be “committed first and foremost to being student-serving” (p. 160). Many HSIs do not have practices and programs aimed towards better serving Latinx students (Santiago, 2006; MacDonald, Botti, & Clarck, 2007; Satterfield & Rincones, 2008; Galdeano, Flores, & Moder, 2012; Santiago, 2012). Since Latinxs have the largest growth rate in the U.S. and have been historically underrepresented in STEM disciplines, ensuring that Latinxs have the same opportunities in STEM careers will strengthen the STEM workforce in the U.S. (Excelencia in Education, 2022). In this work, we emphasize that an HSI should be structured to “serving” rather than only “enrolling” Latinx students following Garcia, Nuñez, and Sansone’s (2019) multidimensional conceptual framework of servingness. Accordingly, like Garcia, Nuñez, and Sansone, in our work, we consider (a) academic and nonacademic outcomes, (b) experiences, (c) organizational dimensions, and (d) external forces.

The incorporation of the community into the policies of educational institutions is key to addressing servingness and creating effective, transformative, and sustainable changes within the institutions (Barnes & Schmitz, 2016). It is through experience in ontological, axiological, and epistemological dimensions that learning can be achieved (Denzin & Lincoln, 2011). Instruction thus requires an understanding and knowing of the student as a human being (ontology), where

the values and ethics allow the teacher to change their beliefs (axiology) and acknowledge their students' ways of knowing (epistemology) (Denzin & Lincoln, 2011). Freire (1970) posited similar views of learning, asserting that teaching is an ongoing process of learning with the teacher-student and student-teacher engaging in discourse as they continue to develop a critical consciousness through the totality of their experiences. In this paper, we propose a novel Family-Centered Theory of Change that challenges our worldview as educators and researchers, as well as institutional practices in higher education. The intersectional framework proposed herein augments the learning process by moving family engagement from the margins of learning to the center to truly address diversity, equity, and inclusion (DEI), and servingness. The integration of family leaders from our community partner, AVE Frontera, into family-centered class projects creates family leaders/teacher and family leaders/students partnerships that nourish the typical teacher-student relationship in and outside the classroom. We hypothesize that by integrating the students' families into the college education process through the praxis of Family-Centered Pedagogy derived from the Family-Centered Theory of Change, a strong positive impact will be observed in the student's learning process, especially Latinx students.

The following questions guide the research, implementation, and evaluation of this project:

1. What is the quality of the design and implementation of the Family-Centered Theory of Change?
2. What is the value of the Family-Centered Theory of Change to students, families, and faculty?
3. What challenges and opportunities can affect the quality of the project implementation and its outcomes?
4. What effect does the Family-Centered Theory of Change have on the transformation of practices and policies at The University of Texas Rio Grande Valley to improve its servingness (Garcia, Nuñez, & Sansone, 2019) as a Hispanic-Serving Institution and on degree attainment?

The theory of change led to the development of a new Family-Centered Pedagogy implemented in five pilot and thirty-two cohort one undergraduate STEM courses at the University of Texas Rio Grande Valley (UTRGV). Preliminary observations suggest that we were able to (a) transform research and pedagogy, (b) enrich curricula in chemistry, mathematics, and physics, and (c) increase participation of students and families from underrepresented communities in STEM disciplines. Theme analysis resulted in three theoretical underpinnings of the newly developed Family-Centered Pedagogy, namely life-transforming experiences, the value of family and education, and a sense of belonging with ownership and pride.

Background

UTRGV is an HSI serving 32000 students. Over 90% of UTRGV students are Latinx, of which the vast majority are Mexican American. In this paper, we will use Latinx and Mexican American students interchangeably. Central to our work is the partnership with AVE Frontera, a local grassroots advocacy group of Latinx family leaders that serves as a vehicle of engagement (hence AVE) that is family-centered and aims to instill cultural pride and awareness amongst its members to fulfill their social, emotional, spiritual, and intellectual needs. The AVE Frontera family leaders' expertise and focus on "Family and Education, the Future of a Nation" and AVE Frontera's Family-Centered Theory of Change makes them an ideal partner to help promote the advancement of historically underrepresented groups in STEM, build transformative, institutional-community partnerships, and to broaden participation in STEM, especially among Latinx communities. The organization was founded in 2016 to develop family leaders by engaging families in their children's education. Between 2016 and 2021, AVE Frontera experienced a 700% growth, serving 160 families (mainly Latinx) and over 200 children from underrepresented communities in STEM (Salinas & Lopez, 2021). AVE Frontera significantly expanded its network of students, families, faculty, and administrators by implementing family-centered programming in colonias (underdeveloped neighborhoods), K-12 public schools, and higher education institutions. These programs promote culturally relevant education, leadership development, civic engagement, dual language acquisition, cultural competence, and DEI. AVE Frontera's motto, "Family and Education, the Future of a Nation," is a philosophy or commitment and an ideology that gives its members a broader meaning and purpose to their present and provides a stake in their community's future. This allows AVE Frontera family leaders to engage deeply with educational leaders to transform educational systems isolated from the historical realities of Latinx students, families, and communities.

The partnership between AVE Frontera and UTRGV aims for Latinx students in STEM to thrive, take pride in their family's traditions, cultural wealth, and heritage, and understand that they are also producers of knowledge. This paper explores the potential institutional transformative impact of a novel Family-Centered Theory of Change implemented through the NSF-funded UTRGV-AVE Frontera Family Integrated Education: Serving and Transforming Academia (FIESTA) program. Our premise is that UTRGV students engaged in our Family-Centered Pedagogy will be able to advocate for themselves, their families, and their community while succeeding in their STEM major. The FIESTA program has impacted over 2000 undergraduate students enrolled in chemistry, physics, and mathematics courses and has yielded significant and tangible preliminary results in curriculum and pedagogical transformation. We have observed increased engagement and participation among undergraduate students and their families from underrepresented communities in the Rio Grande Valley of Texas.

The Family-Centered Theory of Change aims to shed light on improving servingness for Latinx students in STEM at an HSI in a way that pushes faculty and administrators to challenge their worldviews, leading them toward an institutional transformative paradigm (Hurtado, 2015). This

type of work requires a deeper level of engagement with the Latinx communities and centers students' learning around students and their families. We also attempt to build on HSI servingness literature and suggest a new theoretical approach to address equity, diversity, and inclusion concerns to improve Latinx undergraduate STEM education at UTRGV. Based on preliminary findings, we believe that Family-Centered Pedagogy should become a standard across the UTRGV campus and may be implemented in other universities/colleges across the nation concerned with Latinx student success.

Family and Education

In this work, "family," be it the one born into or chosen, is defined as anyone with a close relationship who cares and is interested in the student's well-being. The importance of parental involvement in children's education has been well-documented (Christensen & Sheridan, 2001; Epstein, 2001, 2002; Henderson & Berla, 1994; Michael, 2001; Olmstead & Ruby, 1982; Perlander, 2000; Scottstein & Thorkidsen, 1999; Umansky & Hooper, 1998) and underscores the positive effects on children's education and gains in their developmental skills and milestones. However, teacher education programs have not adequately prepared teachers for parental involvement or family-centered practices (Chavkin, 1991; Epstein, Sander, and Clark, 1999). This is especially true in higher education. The U.S. Department of Education (1997) encouraged the adoption of family-centered practices, and since then, 22 states have included parental involvement requirements in their K-12 credentialing standards (Shartrand *et al.*, 1997). Studies show many benefits of engaging families in their children's education at an early intervention preschool, elementary, and secondary school levels (Henderson, 1988; Davis, 1995; Ryan, 1995; Dunst & Trivette, 1996). However, despite the significant amount of research demonstrating the efficacy of family engagement in K-12, the engagement of students' families in higher education is minimal.

Dunst *et al.* (1991) differentiate among four family-oriented models: professionally centered, family-allied, family-focused, and family-centered. Dunst (2002) defined family-centeredness as (a) beliefs and practices that treat families with dignity and respect; (b) individualized, flexible, and responsive practices; (c) information sharing so that families can make informed decisions; (d) family choice regarding any number of aspects of program practices and intervention options; (e) parent-professional collaboration and partnerships as a context for family–program relations; and (f) the provision and mobilization of resources and supports necessary for families to care for and rear their children in ways that produce optimal child, parent, and family outcomes. Based on the assumptions about family capabilities and the roles professionals and families should play in their involvement in help-giver/help-receiver relationships. Dunst (2002) concluded that most early intervention programs are more family-allied and family-focused than family-centered, and most preschool programs are professionally centered and family-allied rather than family-focused or family-centered. Furthermore, Dunst also concluded that

practitioners in professionally centered programs fared poorly in both relational and participatory practices. Practitioners in family-allied or family-oriented programs generally had good-to-excellent relational skills but fared poorly on participatory practices, and practitioners in family-centered programs demonstrated good-to-excellent practices in both the relational and participatory behavior clusters.

By integrating family into college education through Family-Centered Pedagogy, we aim to increase the self-efficacy, sense of belonging, academic performance, and retention rates of Latinx students in STEM fields such as Physics, Chemistry, and Math at UTRGV. In addition, we encourage STEM students to enroll in a Community-Engaged Scholarship and Learning course focused on Mexican American Studies to help them understand the historical and contemporary realities of Mexican Americans in the Rio Grande Valley, their positionality, and how this impacts STEM disciplines. For the Family-Centered Pedagogy to succeed, however, the Family-Centered Theory of Change must be able to transform teaching and learning practices and curriculum that positively impact students, families, faculty, and administrators.

Origins of the Family-Centered Theory of Change

AVE Frontera was founded in 2016 with the purpose of sharing the knowledge acquired throughout the co-founders' educational and professional careers and from their deep engagement with other community-based organizations. AVE Frontera founders volunteered their time to provide tutoring and mentorship to children, youth, and adults from low-income communities. They also sought support to establish community development activities such as building community gardens, financial aid assistance, and scholarship funds, as well as educational and research opportunities to address issues relevant to the families they serve (e.g., flooding, health, street lighting, recycling, and civic engagement). Their intellectual growth and understanding of building community partnerships through a relational process (Guajardo et al., 2017) were significantly enhanced because of the constant feedback and care they received from family leaders. This relationship of continuous reciprocity, knowledge sharing, and support among family leaders led the AVE Frontera co-founders on a new educational journey of community-engaged scholarship centered around family leaders.

AVE Frontera co-founder's dissertation on the empirical assessment of institutional responsibility using Sense of Belonging (Hurtado & Carter, 1997) and Institutional Integration (Tinto, 1993) metrics was one of several key elements that led to an initiative at UTRGV where concepts of community-engaged scholarship, culturally relevant pedagogy (Ladson-Billings, 1995), and Community Learning Exchange (Guajardo et al., 2017) models were integrated into the CESL (Community Engaged Scholarship and Learning) Framework (Salinas, 2018). The CESL Experiences project aimed to dismantle deficit thinking practices that have historically marginalized Latinx students and their communities with the direct participation of community

organizations. The CESL courses focused on transforming the local communities by co-developing solutions to a problem through community-engaged scholarship and culturally relevant pedagogies.

Through the CESL experiences, the AVE Frontera co-founders realized that their work as educators had to go beyond community engagement, involving families at a deeper level. In 2019, they began to invite families (children, youth, and adults) and other educators who lived in the Rio Grande Valley to join them in pláticas (authentic dialogue) (Guajardo & Guajardo, 2013). The purpose of these pláticas was to build trusting relationships with those families and to share the knowledge they possess. AVE Frontera's network of supporting educators in public schools and the university helped bring about the collective knowledge and experiences families would find valuable to make better-informed decisions about their children's education. The families' deep involvement allowed them to create educational opportunities where their children would be more engaged, and other families could benefit from those activities. This led to families taking on a more active role in their children's education and a leadership role in their community. Through these pláticas, AVE Frontera co-founders and family leaders developed an understanding of "education as a family."

In 2020, AVE Frontera family leaders developed the Conectando Generaciones (Connecting Generations) program that focused and capitalized on family heritage and traditions. This fulfills its mission of creating social, cultural, and educational opportunities that serve as A Vehicle of Engagement (AVE) that links family and education (Lopez & Salinas, 2020). Thus, AVE Frontera developed into a family-centered, grassroots movement, which led to the novel Family-Centered Theory of Change (FCTC) and asserts that (a) students and their families possess vast amounts of funds of knowledge (Veléz-Ibáñez & Greenberg, 1992); and (b) the Community Learning Exchange (Guajardo et al., 2017) model produces reciprocal benefits for students, community, faculty, and campus partners. The FCTC places more emphasis on families, making them feel that there is a community, including academia, to which they belong.

Foundational Axioms

The Family-Centered Pedagogy initiative at UTRGV has impacted over 2000 undergraduate students enrolled in Physics, Chemistry, Mathematics, and Mexican American Studies courses. In addition, with the collaboration of AVE Frontera family leaders, the project impacted over 400 families from underrepresented communities in the Rio Grande Valley. In a survey conducted at the 2022 Fall end-semester symposium, the majority of students, their families, AVE Frontera family leaders, and STEM faculty reported experiencing a one-of-a-kind event. They noted that this was an event where families from the local community came together to support STEM students in a family-friendly, family-integrated learning environment at UTRGV.

Family-Centered Pedagogy integrates the histories and experiences of families from the local communities and builds on the knowledge students bring to class from their familial and community cultural wealth (Yosso, 2005). This pedagogy utilizes culturally relevant instructional methods that honor students' voices and experiences, such as reflective writing, plática, oral histories, and testimonios (DeNicolo et al., 2015; Guajardo & Guajardo, 2013). Family-Centered Pedagogy allows these signature pedagogies commonly used in Mexican American Studies courses to be successfully implemented in STEM courses. The goal is to encourage students to draw on their existing funds of knowledge (Moll et al., 1992) and that of their families to create family-centered teaching and learning practices. Through the Power of Plática (Guajardo & Guajardo, 2013), AVE Frontera family leaders have engaged stakeholders in dialogue to influence and change the mindsets of students, faculty, and administrators. They built trusting relationships with STEM faculty who welcomed them into their classrooms. In general, participating STEM faculty observed the positive impact on their student's engagement and class performance, which reflected the transformative power of the Family-Centered Pedagogy.

In summary, the transformational impact among students, families, faculty, and administrators shows that AVE Frontera's Family-Centered Theory of Change serves as a vehicle of engagement that links Family and Education (Salinas & Lopez, 2020) and that all family leaders:

- can contribute with ideas and experiences that have value;
- can learn from each other;
- want to contribute to building a better future for their children;
- value their family traditions and heritage;
- believe in and support their children's ideas, aspirations, and talents;
- serve the community by sharing their knowledge;
- value each other's knowledge;
- build trusting relationships;
- value each other's beliefs and family traditions; and
- value and appreciate all members of each family.

Description of the Change Process and Model

AVE Frontera's work is centered around understanding the axiomatic attributes that family leaders bring, which allow them to continuously exchange intellectual knowledge and cultural wisdom with students, families, faculty, and administrators. AVE Frontera's Family-Centered Theory of Change FOSTERs (Family Organizing, Strategic Training, Education & Research) family and education partnerships that transform students, their families, and faculty through the following processes and methods. To join the iterative process, families and individuals only need to believe in the cause, "Family and Education, [is] the Future of a Nation," and engage deeply in the work.

Family Organizing

Family leaders from AVE Frontera engage in authentic dialogue with other families through social, cultural, and educational activities and events (Family-Centered Sharing of Knowledge). Family leaders from AVE Frontera have extensive experience engaging with families, educators, and administrators in critical conversations. To recruit and organize new families, they share the support, growth, and benefits they continuously gain as family leaders. Through pláticas, this form of recruitment and organizing becomes organic in the sense that families feel an instant connection with other families because they share the same values and goals for their well-being and that of their children. The expected outcome of this process extends beyond fellowship. It establishes a support system of family leaders who, in turn, serve other students and families from the community.

Strategic Training

AVE Frontera family leaders receive ample opportunities to socialize and interact with other families with similar and diverse backgrounds. On a weekly basis, through pláticas, every family member gets to express their ideas, learn from other family members, expand their knowledge with new ideas, and gain new perspectives. The children and youth often cannot express their aspirations and goals to other adults. However, at AVE Frontera pláticas, they feel more compelled to share when they have the sensation of a safe, family environment. Thus, even if the student's family may not have the information and experiences needed to help their children succeed academically, the support of the other families, students, and faculty alleviates this need, increasing the student's sense of belonging. In these pláticas, children and youth often find role models that enrich their academic experience. This is particularly true for students who are normally academically repressed or feel they do not belong in a university setting.

Education and Research

AVE Frontera pláticas and training provide families (children, youth, and adults) opportunities to share their family traditions and memories (Connecting Generations). This is notably meaningful because older generations feel it is important to communicate and share their experiences with younger generations. Sharing this knowledge gives all participants a new appreciation of their roots, customs, culture, language, and/or family heritage. During in-person meetings and/or training webinars, participants build on each other's ideas and memories, allowing them to reconnect with their own culture, bring back good memories and traditions, relearn the native language of their ancestors, and build renewed cultural pride among them. The family-centeredness of this approach makes this a multicultural model that is inclusive and promotes diversity and equity, which can enrich educational and research experiences, especially in STEM disciplines.

“Family and Education, the Future of a Nation” is a grassroots movement that has been key to the transformative and sustained impact on family leaders. Faculty who welcome family leaders into their classroom, implement family-centered pedagogical practices, and see the impact on their students and themselves soon begin to incorporate those practices to expand their research. For this reason, we believe that to establish sustainable family-centered partnerships, the change process must begin with family organizing and must take place in a safe, family-friendly environment (e.g., home, community-based organization, or community center). Then, family leaders can help faculty create family-friendly environments in their classrooms and across their institution. Figure 1 depicts AVE Frontera’s Family-Centered Theory of Change model with permeable boundaries that signify how each level can be interlaced.

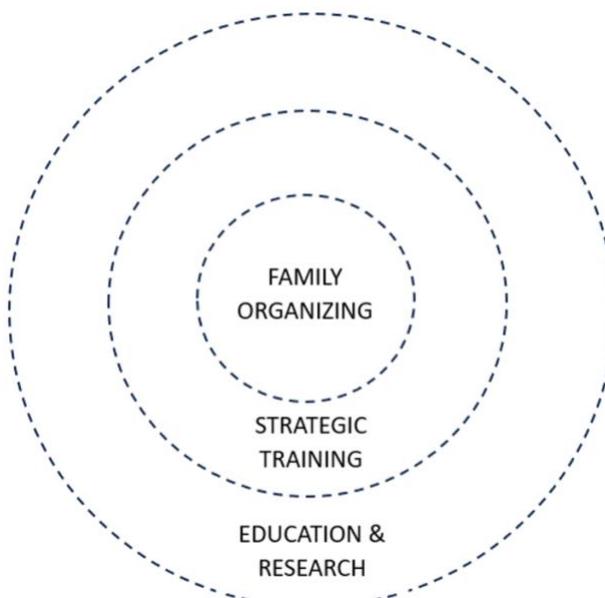


FIGURE 1. AVE Frontera’s family-centered theory of change model.

Conceptual Framework

While Valencia (2010) exposed deficit practices and policies in education, he also posited strategies to dismantle deficit approaches that hinder and marginalize underrepresented students. Schreiner, Louis, and Nelson (2012) built on this notion of dismantling deficit-thinking approaches by emphasizing strength-based models and practices that nurture students' knowledge and skills while managing “deficiencies.” This philosophy or perspective focuses on developing students' strengths and talents by restructuring resources to create opportunities that may lead to higher levels of engagement in the learning process, especially as classroom practices.

The FIESTA framework is grounded in various theoretical approaches. First and foremost, FIESTA incorporates the Family-Centered Theory of Change with an intersectional lens (Garcia, Nuñez, & Sansone, 2019). First introduced by Kimberlé W. Crenshaw (1989), intersectionality examines and puts at the forefront how social identities, race, gender, and economic status intersect and relate to systems of oppression and discrimination. As an institution, UTRGV has slowly adopted these models for student success. Nevertheless, it is within Mexican American Studies that such intersectional models for not only pedagogy but also self-discovery have been reimagined, embedded, and translated into the FIESTA framework. Therefore, FIESTA is grounded in the belief that students and families from the Rio Grande Valley come with vast amounts of funds of knowledge. Within the FIESTA, the Family-Centered Theory of Change with an intersectionality lens taps into the students, their families, and AVE Frontera family leaders' funds of knowledge. It puts them at the center of the learning process.

This approach aims to dismantle deficit thinking practices in our classrooms by capitalizing on AVE Frontera family leaders' strengths and talents and integrating them into the learning process in family-centered and culturally relevant class projects. Essentially, family leaders are affirmed as intellectual equals in an academic space, transforming the power dynamics and redefining what has historically been considered "knowledge." Figure 2 presents the conceptual model of how the Family-Centered Theory of Change with an intersectionality lens purports to improve servingness and a sense of belonging for students from underrepresented communities, especially Latinx students. It is within these intersections that the new pedagogical practices are transformed such that (a) domains of power are challenged in a way that students, their families, and family leaders learn from each other as intellectual equals; (b) students' multiple social identities are affirmed and valued; (c) historicity is centered and acknowledged so that the students' family heritage is valued while acknowledging the historical and detrimental role of colonization; and (d) institutional social responsibility instills a sense of belonging.

Family-Centered Partnership Dynamics

Five courses implementing the Family-Centered Pedagogy were taught first by the research team composed of chemistry, physics, mathematics, and Mexican American Studies faculty as a pilot in the Spring 2022 semester at UTRGV. The mathematics, physics, and chemistry course syllabi were redesigned to incorporate family-centered projects and collaboration with family leaders from AVE Frontera. We also encouraged STEM students to enroll in Mexican American Studies courses to help them familiarize themselves with the historical realities of Mexican Americans in the Rio Grande Valley.

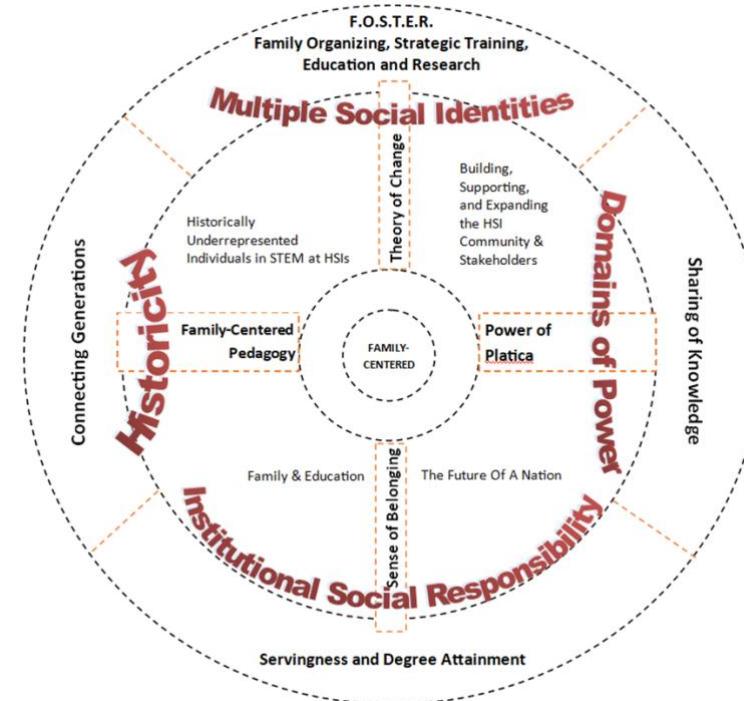


FIGURE 2. FIESTA conceptual framework model family integrated education: Serving and transforming academia.

The course transformation planning occurred during the initial faculty professional development community learning exchange, where the research team focused on integrating Family-Centered Pedagogy and servingness through pláticas. AVE Frontera family leaders led the session. The pláticas held during the community learning exchange catalyzed to enrich the curriculum in undergraduate, introductory courses in chemistry, physics, mathematics, and Mexican American Studies. The norms established for the session followed the axiomatic foundations of the Family-Centered Theory of Change (FCTC) described above. To emphasize inclusivity, it was agreed that professional titles would be omitted. The family leaders' goals for the session were: (a) build confianza (trust) by creating relational partnerships; (b) serve and transform lives by affirming students', families', faculty's, and administrators' identities and valuing their family heritage, knowledge, and experiences; and (c) instill a sense of belonging by inviting and welcoming family leaders into the classroom and the teaching and learning process.

After the FIESTA team implemented Family-Centered Pedagogy practices during the pilot semester, it was established that three classroom visits for collaboration with family leaders would be scheduled during the semester. The first visit was to introduce students to (a) the mission of AVE Frontera, (b) to learn about the student's knowledge of other community organizations that serve families of the Rio Grande Valley, (c) to create a family-friendly environment, (d) to describe and model the Family-Centered class project, and its connection to the course content. During this initial visit, students and family leaders shared what

chemistry/physics/mathematics meant for them and how it related to their experiences. Moreover, family leaders brought artifacts (e.g., tools, recipes, household items, plants, etc.) and explained their importance and significance in their lives. In one of the chemistry courses, for instance, family leaders showed medicinal plants to the students, explaining how they are used and if the natural remedy is a family tradition of many generations. The second visit strengthens the communication between family leaders and students, allowing the latter to explain the purpose of their respective projects. During this second visit, students share their family-centered project ideas with family leaders, provide preliminary information on the family history or tradition behind their chosen project, and indicate which member(s) of their families proposed the idea. After each presentation, family leaders first share with the students what they had learned and how the science validated their families' ancestral knowledge. Then, the family leaders provide the students and instructor with comments, ideas, and suggestions on making a strong connection and having a more positive experience with families attending the end-of-semester symposium. Family leaders also encourage students to be prepared to translate their presentation into English and/or Spanish. They also suggest beginning their presentation with a personal story that connects chemistry, physics, or mathematics concepts with real-life experiences. A reviewed version of the projects is presented during the end-of-semester symposium. Students present a poster that includes the suggestions made by family leaders. The students prepare a final report to complement their class presentations and submitted to the instructor for formal evaluation of the project. While the poster and presentations are focused on family connections with chemistry, physics, or mathematics concepts, the final report focuses more on the academic aspect of the topic (e.g., conceptual understanding, applications, relevant scientific literature, future research, etc.). After the pilot semester, the research team organized a 3-day professional development workshop at the Summer Institute for new faculty recruits to incorporate the Family-Centered Pedagogy into other chemistry, physics, mathematics, and Mexican American Studies courses. The faculty from the research team served as mentors for the recruits.

Implementation of Family-Centered Pedagogy in STEM, Cohort 1

During days one and two of the professional development workshops of the Summer Institute, faculty members from chemistry, physics, mathematics, and Mexican American Studies, along with AVE Frontera family leaders, engaged in critical conversations. These conversations included (a) building relationships among all participants; (b) Equity, Diversity, and Inclusion (EDI) in education; (c) historical realities of the students and families of the Rio Grande Valley; (d) students' social identities; (e) deficit thinking and asset-based approaches to education; (f) servingness; (g) student, family leaders, and faculty testimonials of the impact of the Family-Centered Pedagogy; (h) Mexican American Studies pedagogies; and (i) the change of power dynamics experience in the classroom.

During day three of the Summer Institute, each co-PI met with their corresponding cohort and family leaders to discuss how one might implement Family-Centered Pedagogy in their respective courses, to invite AVE Frontera family leaders, to schedule the classroom visits, and to make changes in the syllabus that reflected the integration of the students' family-centered class projects and family-centered praxis.

Chemistry

Five faculty members and co-PI from the chemistry department implemented the newly developed family-centered pedagogy in the fall of 2022 and spring of 2023. The faculty recruited and co-PI teach undergraduate entry-level or gateway courses, are Latinx, fluent in Spanish and English, have similar backgrounds as the UTRGV student population, and have experience implementing project-based teaching and learning into their courses. Overall, 14 different sections of several courses (General Chemistry I, General Chemistry for Engineers, Organic Chemistry I and II, and Biochemistry) were redesigned to include family-centered class projects.

Physics

Three faculty members and co-PI from the physics department implemented the newly developed family-centered pedagogy in the fall of 2022 and spring of 2023. Two faculty members are Latinx and Spanish speaking, and two are neither Latinx nor Spanish speaking. The faculty recruited and co-PI taught undergraduate entry-level or gateway courses in the fall of 2022. In the spring of 2023, two faculty members incorporated Family-Centered Pedagogy in upper-level Physics courses. Eight sections of several courses (General Physics I and II, Astronomy, Optics, and Math Methods in Physics II) were redesigned to include family-centered class projects.

Mathematics

Six faculty members from the School of Mathematical and Statistical Sciences implemented the newly developed Family-Centered Pedagogy in the fall of 2022 or spring of 2023. Four of the faculty are Latinx and Spanish speaking, and two are neither Latinx nor Spanish speaking. Five of the faculty recruited taught undergraduate entry-level or gateway courses in the fall of 2022. One upper-level Math Education course was taught in the fall of 2022 and was repeated by a different instructor in the spring of 2023. All eight sections of several courses (College Algebra, Pre-Calculus, Elementary Statistical Methods, and Research Methods in Middle and Secondary School Math) were redesigned to include family-centered class projects.

Mexican American Studies

Four faculty members and one graduate student taught a 1-credit hour Community Engaged Scholarship and Learning course focusing on Mexican American Studies. All instructors identify as fluent in Spanish and English and are Mexican American. This seminar-style course in Mexican American Studies addresses the intersectional ties between historicity, social identities, and domains of power, focusing on the Río Grande Valley and incorporating family-centered and place-based pedagogies. Overall, eight sections of this course were taught between the fall of 2022 and spring of 2023.

Preliminary Findings

During the 2022-2023 academic year, the Family-Centered Pedagogy initiative impacted over 1,200 undergraduate students enrolled in physics, chemistry, mathematics, and Mexican American Studies courses and over 300 families, of which the vast majority are Latinx from the Rio Grande Valley. Findings from the theme analysis of open-ended questionnaires conducted at the 2022 Fall end-semester symposium and supported by student, family, and faculty testimonials, classroom observations, and focus group interviews can be grouped into three theoretical underpinnings of Family-Centered Pedagogy. Qualitative and quantitative data are currently under review. Qualitative analyses will concentrate on the impact and experiences of students, families, and faculty. Quantitative analysis will concentrate on the overall effects of Family-Centered Pedagogy on passing rates, retention rates, grade distribution, and sense of belonging. The survey, focus group, and observational data were collected throughout the professional development workshops, classroom implementation, and end-of-semester symposia.

Theoretical Underpinnings of Family-Centered Pedagogy

Definition of Family-Centered Pedagogy

We define Family-Centered Pedagogy as enriching the teaching and learning experience in which students complement their instruction by drawing from the experience and ancestral knowledge of their families and AVE Frontera family leaders.

Life Transforming Experiences

Ongoing professional development helped all participating STEM faculty transform their teaching practices by incorporating family-centered, project-based learning where students investigated content applications in their real-life experiences and those of their families. Faculty increased their awareness of the historical realities of students and families who live in the

communities UTRGV serves, changing their teaching philosophy. By knowing more about their students' lives, faculty found ways to make learning more relevant and equitable. For instance, one faculty member shared, "This reminded me why I love teaching. During the break, I even called my wife to share what we are discussing and why I feel rooted in working with the students and their families." These new experiences gave faculty a new meaning and perspective to their role that allowed them to serve their students in their classroom better. Students benefited from the creation of a family-friendly and dynamic classroom environment where students are more enthusiastic, attentive, and willing to ask questions about the topics studied. Students also gained more confidence to approach the professor seeking academic and research opportunities. A faculty member stated, "At first, students are shy and do not feel comfortable interacting, but as soon as we as professors start sharing about our personal story, they begin to open up and form relationships that will transform the communication in the classroom." Another faculty member mentioned, "I went on to apply this same project in my Advanced Physics Optics class because this project works for all levels, introductory and upper level. The results have been much better with time. Trust your students."

The Value of Family and Education

By implementing Family-Centered Pedagogy, all participating STEM faculty transformed and enriched their curricula in introductory and/or gateway chemistry, physics, and mathematics courses. This enrichment allowed students, mainly Latinx, to connect their identity and their family heritage to the topics studied in their STEM courses. As a student noted, "These projects provide us [students] with opportunities to connect with families and the community as a source of inspiration to do well in school." Students benefited from their projects' research experience, and many recognized that their course of study has the potential to impact and transform people's lives. Additionally, students' family members were able to help and support the students in completing their projects and appreciate the value and significance of their education. As per one of the testimonies from participating faculty, "the [family leaders] came into the classroom and created a culturally welcoming environment with the students. They connected as families, sharing their connections."

Family leaders were allowed to share their knowledge in a university classroom where they interacted with students and faculty. During these visits, they shared personal stories as well as their academic and professional interests and goals for themselves and their children. "The AVES [family leaders] provided feedback and encouraged students to improve their projects, engaging them to go deep into their research," said another faculty member. Similarly, students were able to describe their ideas on how to integrate their own families into their respective projects. Thus, students learned from their own families and the family leaders. At the same time, family leaders learned from the students, resulting in an intergenerational exchange of knowledge and learning. Many felt unconditional and authentic support from family leaders as if

they were their own families. A faculty member stated, “[visits from family leaders] did not delay my textbook instruction. It made our classes more interesting because the students would share their ideas and start discussions.”

Sense of Belonging with Ownership and Pride

During the visits, family leaders realized they possess knowledge that students can use in their courses, even if the families possess limited formal education. Family leaders felt validated academically since their suggestions were included in the students' project presentations at the end-of-semester symposium. Thus, family leaders felt comfortable in the classroom and no longer felt that the university environment was beyond their reach. They recognized that a university education is a way to improve their quality of life, not only to obtain financial gain. The sense of belonging was such that several family leaders visiting the classrooms are currently enrolled in college courses. A faculty member commented, “For my Chemistry class, I wanted to include all the families, so we started by doing different types of personal discussions about our background and then we formed groups based on the periodic table.”

AVE Frontera youth leaders who are now UTRGV students created a new student organization, ALAS (Association of Leaders Advancing Servingness), currently led by a diverse group of undergraduate, first-generation students. One of the co-authors is the founding faculty mentor for ALAS. This organization is open to all students throughout the university, and it was founded to provide support to all who may be experiencing marginalization through critical transitions that could hinder their sense of belonging. Their goal is to collaborate with AVE Frontera family leaders and faculty who have built trusting relationships and a true sense of family to help students successfully transition into and graduate from college. An AVE Frontera family leader shared that “Cuando plantas la semilla y lo toman y luego corren con eso. Eso es emocionante” (When you plant a seed [ideology] and they take it and then run with it. That is exciting). This quote shows that an AVE Frontera family leader is proud to see that youth leaders are excited, motivated, and committed to advancing servingness by taking on a leadership role in “their” university as stakeholders. A faculty member expressed that “Hispanic culture, including Spanish language, is very important for Hispanic students because it creates a sense of belonging. A [STEM] student who was accepted in … [the name of the university was removed] discontinued her studies because she did not feel connected culturally.”

Conclusion

Using the novel Family-Centered Theory of Change, we have been able to (a) initiate a transformation of research and pedagogy, (b) enrich curricula in chemistry, mathematics, and physics, (c) increase the participation of students and families from Latinx communities in STEM disciplines, and (d) expose students to the culturally sustaining pedagogy of Mexican

American Studies. Part of this project's success and transformative power is due to a deeper level of engagement among UTRGV upper administration, project co-leaders, faculty, and family leaders from AVE Frontera, as it aligns well with the institution's mission. Strong relationships have been built that are committed to improving UTRGV's servingness with intentionality (Garcia, Nuñez & Sansone, 2019). The Family-Centered Theory of Change is intrusive, dynamic, intersectional, multicultural, and adaptive. It is also helping UTRGV leaders build faculty support to reshape the university's unique identity as an HSI and in affirming a bilingual, bicultural environment both inside and outside the university. The preliminary findings suggest that this initiative has the potential to shed new light on a "sense of belonging with ownership and pride" and Institutional Social Responsibility (Salinas, 2018) among Latinx students, families, and participating faculty.

The research team observed the following preliminary effects and contributions to teaching, learning, and research of the Family-Centered Theory of Change: (a) faculty transformed their teaching practices and increased their awareness of the historical realities of students and their families and their positionality in the classroom and community, making learning more relevant, equitable, and inclusive; (b) students were able to see their family heritage incorporated into the curriculum and benefited from a supportive learning environment, which included their families; and (c) families shared their knowledge in a university classroom setting while collaborating with students and faculty alike contributing to the learning process. These intergenerational interactions instilled in the students, families, and faculty a strong "sense of belonging with ownership and pride" to their university and community. This work and preliminary results show promising possibilities to improve undergraduate STEM education at UTRGV.

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