



UTEP TLC students' experiences of language policies in TLC courses: An educational language policy & engagement action research study

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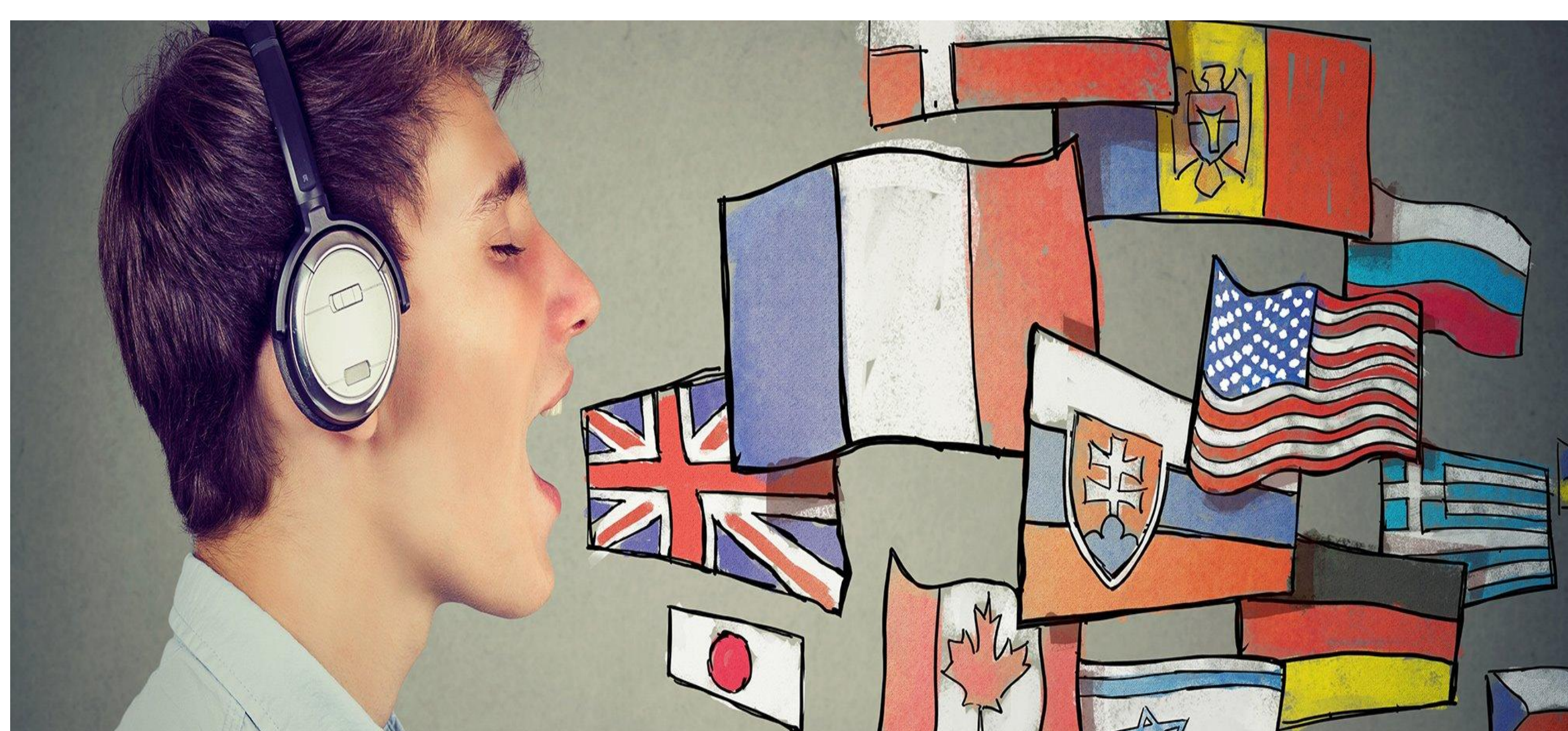


Introduction and objectives

Educational language policy and engagement action research (ELPEAR) is a reflective and collaborative research method focused on analyzing critical power dynamics in language policy and effecting positive change in education. As part of the doctoral course BED 6318 Language policy in education, the class identified a topic and research question important to us: TLC doctoral students' experiences of language policies in TLC courses. We then designed this survey-based study to capture the voices of participants students regarding the level of support they received in various language policies and practices from faculty and peers. We used this analysis to produce recommendations for classroom practices.

Research questions

What are the learning experiences—in classroom participation and assignments—of UTEP TLC doctoral students whose primary language is not English? To what extent do TLC students feel that their linguistic repertoires are recognized in TLC classes?



Theoretical Frameworks

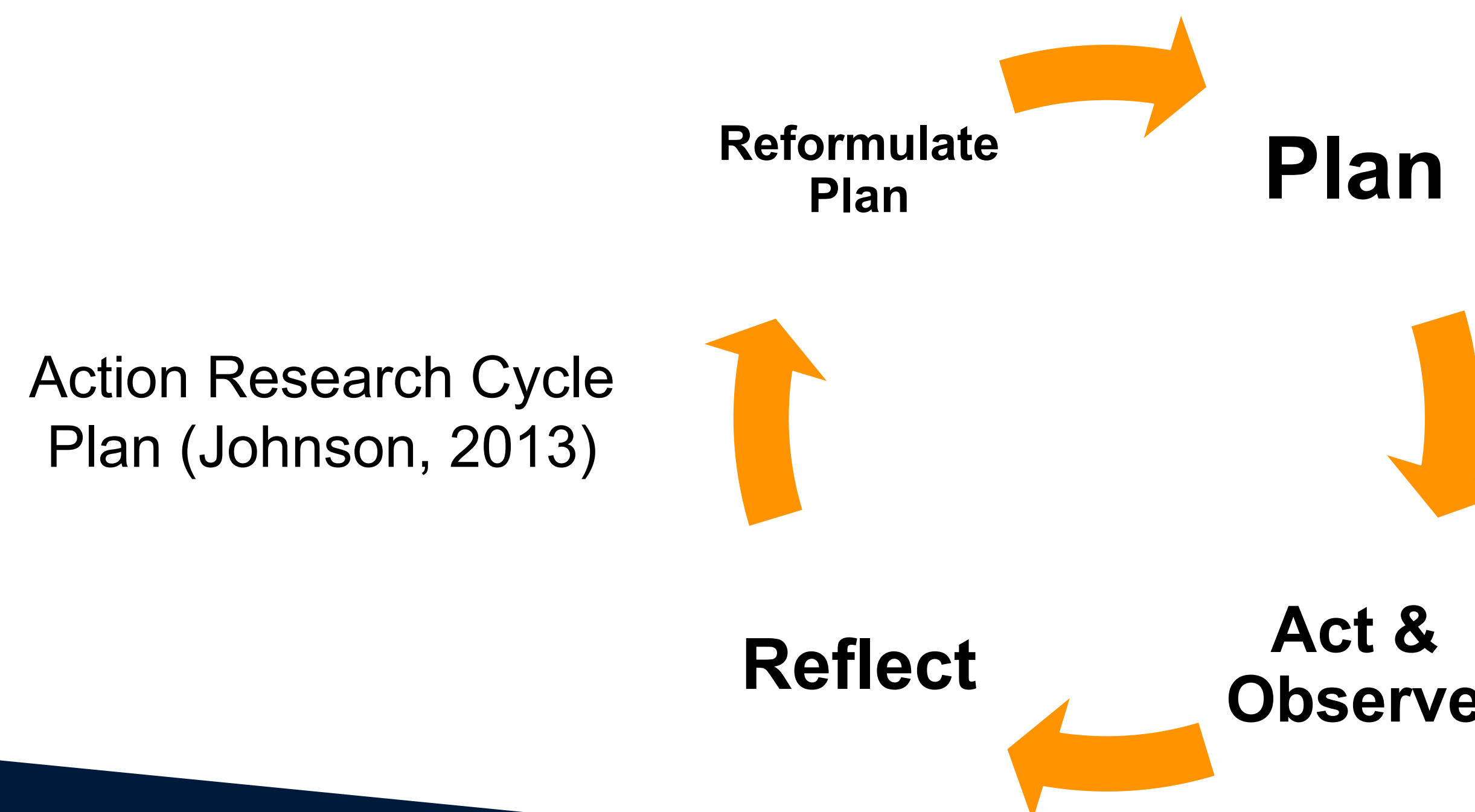
Language policy as texts, ideologies, and practices (Spolsky, 2004)

Instructors and students as policymakers (Ricento & Hornberger 1996)

Translanguaging has a crucial role in pedagogical practice (García, 2009; Makalela, 2022; Schissel et al., 2019)

Methodology

Our study was designed according to the action research cycle for language policy as outlined by Johnson (2013).



The process used to develop our ELPEAR

- Collaboratively developed and refined research question
- Data collection via survey with open ended and Likert scale questions
- Disaggregated responses and divided into qualitative and quantitative categories
- Coded and scaled questions and quantified some open-ended questions
- Analyzed qualitative data using thematic analysis
- Organized data, developed themes, verified frequencies

Findings (continued)

Respondents' Perceptions of Multilingual Language Policies in TLC Courses

Want flexible language policies

Respondents request a language policy that encourages students to leverage their complete language repertoire.
"We would have a more enriching experience"

Concerns about having multilingual language policies

Respondents say that there is a need to develop strategies to overcome potential language obstacles by offering resources for faculty adapting to a multilingual approach.
"...it will also mean a lot of work for both professors and peers"
"I don't think everyone in my class speaks Spanish, how would they understand me?"

Interest in a diverse learning environment

Respondents value an inclusive atmosphere for international students by providing "third spaces" or areas for diverse linguistic and cultural exchange.
"You can express yourself more openly" and offer "proper time to get used to the doctoral degree program"

Recommendations

Recommendations for TLC doctoral program faculty:

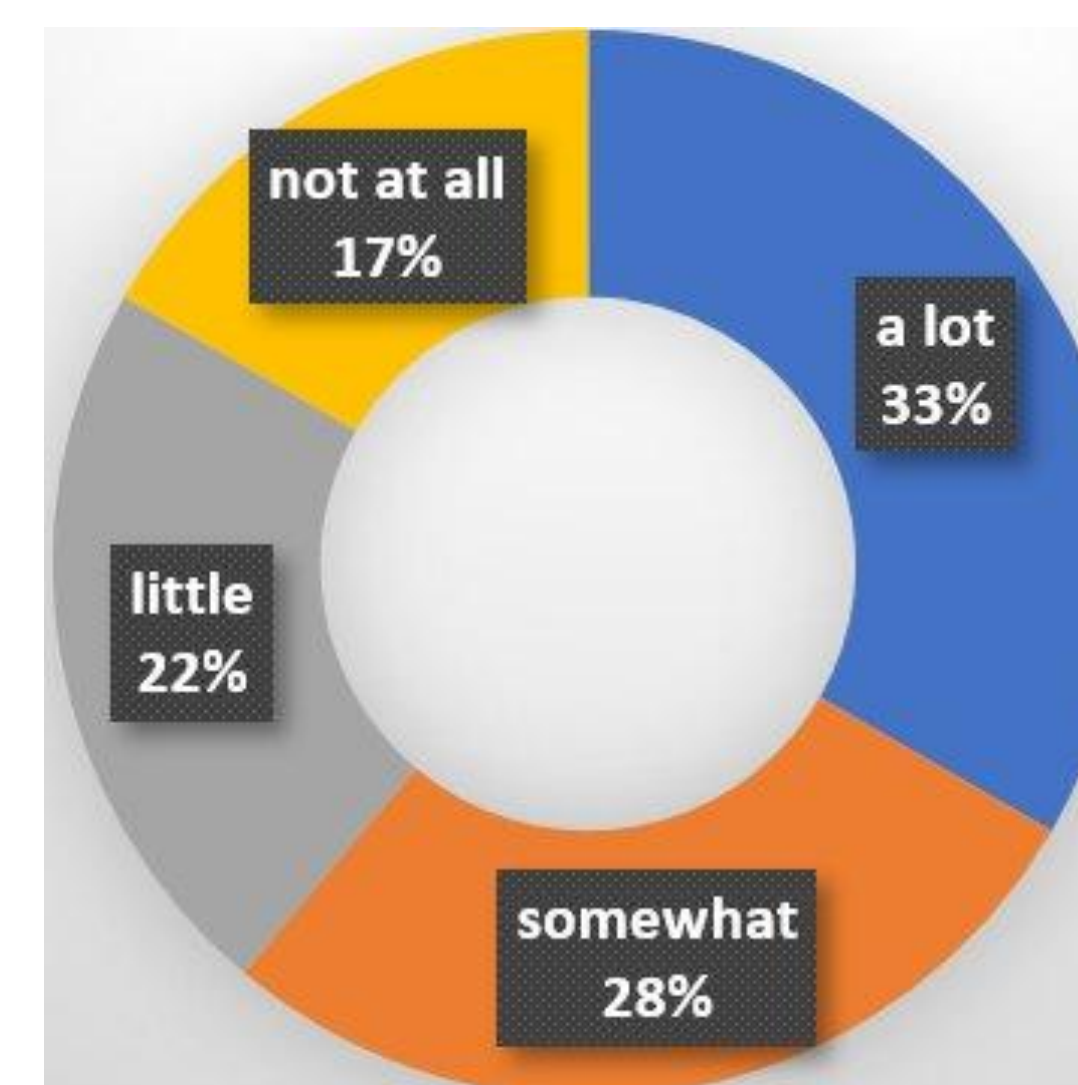
- Make additional support explicit in syllabi
- Integrate multilingual repertoires in TLC classes
- Address potential barriers to integrating multilingual repertoires
- Create a diverse learning environment
- Invite/allow translanguaging practices in TLC courses
- Foster students' linguistic repertoires
- Invite submission options in languages other than English

Recommendations for TLC students:

- Take advantage of linguistic accommodations
- Be supportive among peers
- Know that there is an option of dissertation language preference
- Be aware of equity of opportunities for all students

Findings

• Most participants indicated that their linguistic repertoire is taken into consideration by faculty members and by their peers.



- Supportive faculty (description of 'supportive', 'open', 'flexible', 'comfortable environment')
- For example, "Allowed the submission of assignments in the language we feel most comfortable in"
- Supportive peers ('supportive', 'understanding', 'encourage me to stand up for myself')
- Participants reported inconsistent practice across classes; no written policy

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Introduction

- Teacher stress is understood to be problematic for the well-being of teachers^{1,2}, but also for child outcomes in academic, socioemotional, and executive function development.^{3,4}
- Early childhood education (ECE) teachers further withstand teaching stress, that which accounts for the emotionality of working with young children.⁵
- Most research however, examines teacher and teaching stress by implementing traditional participant-reported surveys.
- Understanding the potential bias associated with surveys of self-report⁶, the current work examined a physiological measure of stress (hair cortisol concentration) combined with qualitative interviews to more comprehensively understand ECE teacher well-being.

Objectives

- A part of a larger, on-going study characterizing the psychological and physiological stress of ECE teachers in one participating school district, the current research compared cases of ECE teachers by
- comparing hair cortisol levels (i.e., Low, Medium, High pg/ml⁷) and
 - lived experiences including
 - sources of stress, and
 - the less-often reported affirmations of teaching

Methodology

- Of the previously collected quantitative data, three teachers were selected for this comparative case study based on the collection of:
- complete demographic and medication survey data,
 - successful sampling and analysis of hair; demonstrated difference in level of cortisol concentration⁶, and
 - the completion of one individual, semi-structured interview

Analysis

- Hair samples were collected and thereafter assayed according to standard protocol⁸ by collaborators in the Human & Animal Integrated Research (HAIR) Lab (PI: Dr. Amanda M. Dettmer, Ph.D.) located within the Yale School of Medicine's Child Study Center

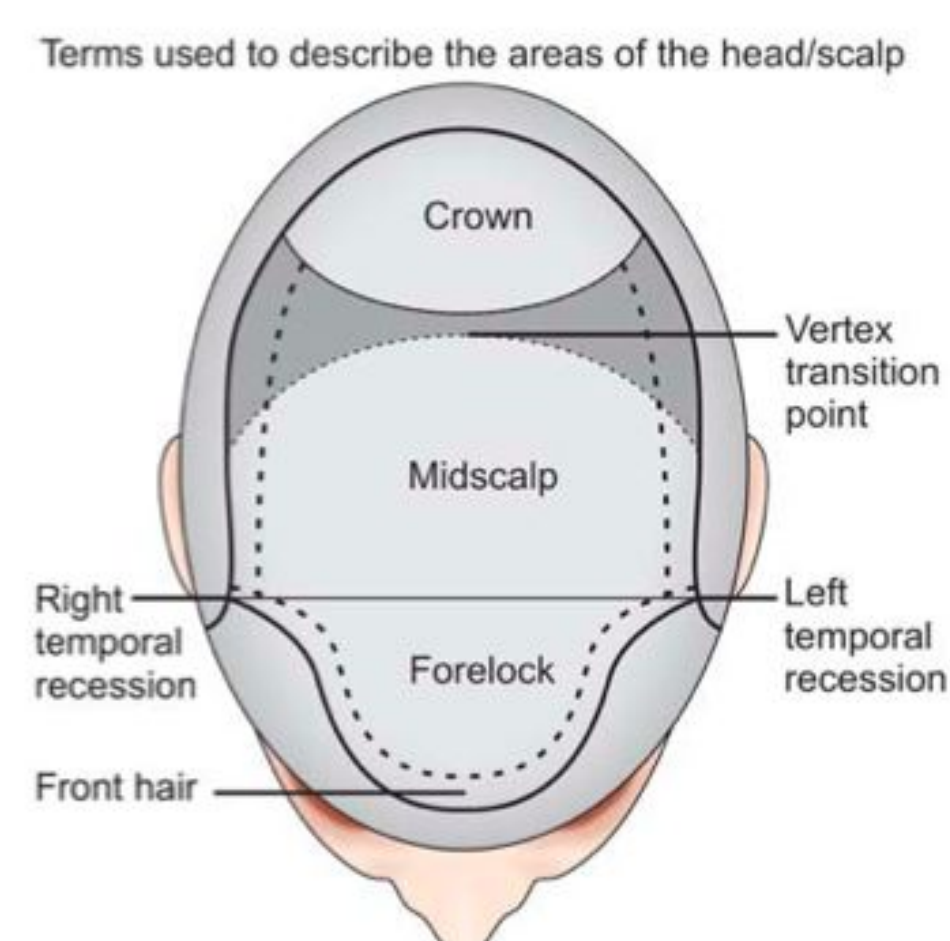


Figure 1: Terms used to describe the areas of the head/scalp.

- Interview transcripts were cleaned and inductively coded to reveal emerging themes⁹ related to ECE teacher well-being
- Taken together, the quantitative and qualitative data were analyzed to reveal a portrait of each case

Results and Findings

When comparing the three cases, the data reveal **6 main themes** affecting teacher well-being:

- COVID-19 pandemic
- Teacher Responsibility
- School Structure and Logistics
- Social Effects
- Personal Effects, and
- Finances

Table 1.

Primary → Secondary → Tertiary Coding Themes

Theme	Positive	Negative
COVID-19	Children were happy to return to the classroom, New-found appreciation from parents	Child developmental delays, Working online, Illness, Death
Teacher Responsibility	Making an impact in children's lives	Working off-the-clock, Unable to care more for the children, Expectations
School Structure & Logistics	-	Teacher shortage, Unstable work, Teacher and student evaluations, Unfair repercussions, Curriculum coaches with too much to handle, Administration as overworked, Lack of support
Social Effects	Administrative support, Principal support, Parental support	Administrative pressure, self-reported anger/misunderstanding, Parental pressure
Personal Effects	Passion for teaching, Self-care, External Support	Work-life balance, Always busy, Mental health, Passion decreasing, Caregiving pressure
Finances	-	Compensation

Table 2.

Comparison of Physiological Stress Level and Informing Quote

ID	Hair Cortisol Concentration Value (pg/mg)	Main Theme; subsequent theme	Relevant Quote
14	3.0 (Low)	Covid; Negative; Child developmental delays	"...they didn't know how to do just the basic things that when we start in July, like grabbing a pencil, grabbing a crayon and following the directions, cutting, you know, let's sit down, let's stand up, let's go here, let's go there because over Zoom the parents were always there helping, the parents were always there helping them cut, helping them with their, with their projects..."
		Personal Life; Positive; Passion for teaching	"I didn't want it to be anything, I just wanted to be a teacher."
10	4.4 (Medium)	Personal Effects; Negative; self-care	"I'm guessing I don't know if it was a stress or what it was, but I was feeling very tense and because of the whole tension, my body was aching everywhere and I did not want to to accept that it was becoming a problem until I couldn't really deal well with the kids so I went to a chiropractor and he helped a ton and finally I told myself, "okay, I need to take care of myself before I can take care of the kids at school, of my of my family." "
		Teacher Responsibilities; Positive; impacting children's lives	"I would love for them to know that pre-K is very important in the kids' lives, it sends the foundation to everything I feel that if they have bad pre-k year, it completely destroys their vision of what school really is."
8	18.4 (High)	Teacher Responsibility; Negative; work	"Now whenever we tell teachers, 'Hey, let me, we have to do this. Let me show you this.' They're...crying like literally crushed in tears at me and I'm trying to support them as best as I can, but it's hard to see them, like, in tears. I've never seen that before. It's been a rough year for them."
		Theme; Positive; theme	The participant did not record any positive affirmations.

Discussion



- Our research confirmed challenging issues within the ECE profession which cause teachers undue amounts of stress.
- Matching quantitative cortisol concentration results with qualitative interview findings allowed us to more **comprehensively compare experiences**.
- Teaching in the ECE context is challenging. Not only are ECE teachers burdened by the **profession itself** (e.g., compensation), but also by the **relationships** with administration, maintaining a healthy **work-life balance**.
- While participating teachers endorsed similar stressors, Participant 14 (3.0 pg/ml; **Low**) revealed a **love of teaching** that may have offered a counterpoint to stressors experienced, while Participant 8 (18.4 pg/ml; **High**) **already sought other work**.
- While this comparative case study is limited in scope and generalizability, it highlights lived experiences that may inform the current **resignation and teacher shortage crises**.
- For example, these results and findings may inform policy and practice. Moving forward, perhaps teachers who demonstrate **High** levels of cortisol concentration could be counseled in an effort to retain and support.
- This policy and practice directive could have **implications** that positively impact children in the classroom as 1) teachers may be less inclined to leave, avoiding disruption in socioemotional and academic development for children, and 2) improved overall teacher well-being is known to positively affect the classroom context.
- Future studies** may want to examine 1) **larger samples** of ECE teachers, and the 2) socioemotional, academic, and executive function outcomes of children enrolled in classrooms of teachers who demonstrate **Low, Medium, and High** cortisol concentration levels.

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Wounded Healers: The Stigma of Mental Health Illness among Latino Graduate Students



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Introduction

Overarching Framework: Wounded Healer

Carl Jung coined the term “wounded healer” to point out the “wounding” of counselors and therapists may enable them to empathize more fully with their own clients (Fear, 2022).

Terms

Trauma: an emotional response to a terrible event like an accident, rape, or natural disaster. Immediately after the event, shock and denial are typical (American Psychological Association, 2017).

Adverse Childhood Experiences: Potentially traumatic and often common events that occur during childhood (0-17 years old) that have lasting effects on their adult lives.

Counselors-in-Training: Graduate students training counselors studying for their master’s degree in mental health, school, and rehabilitation counseling.

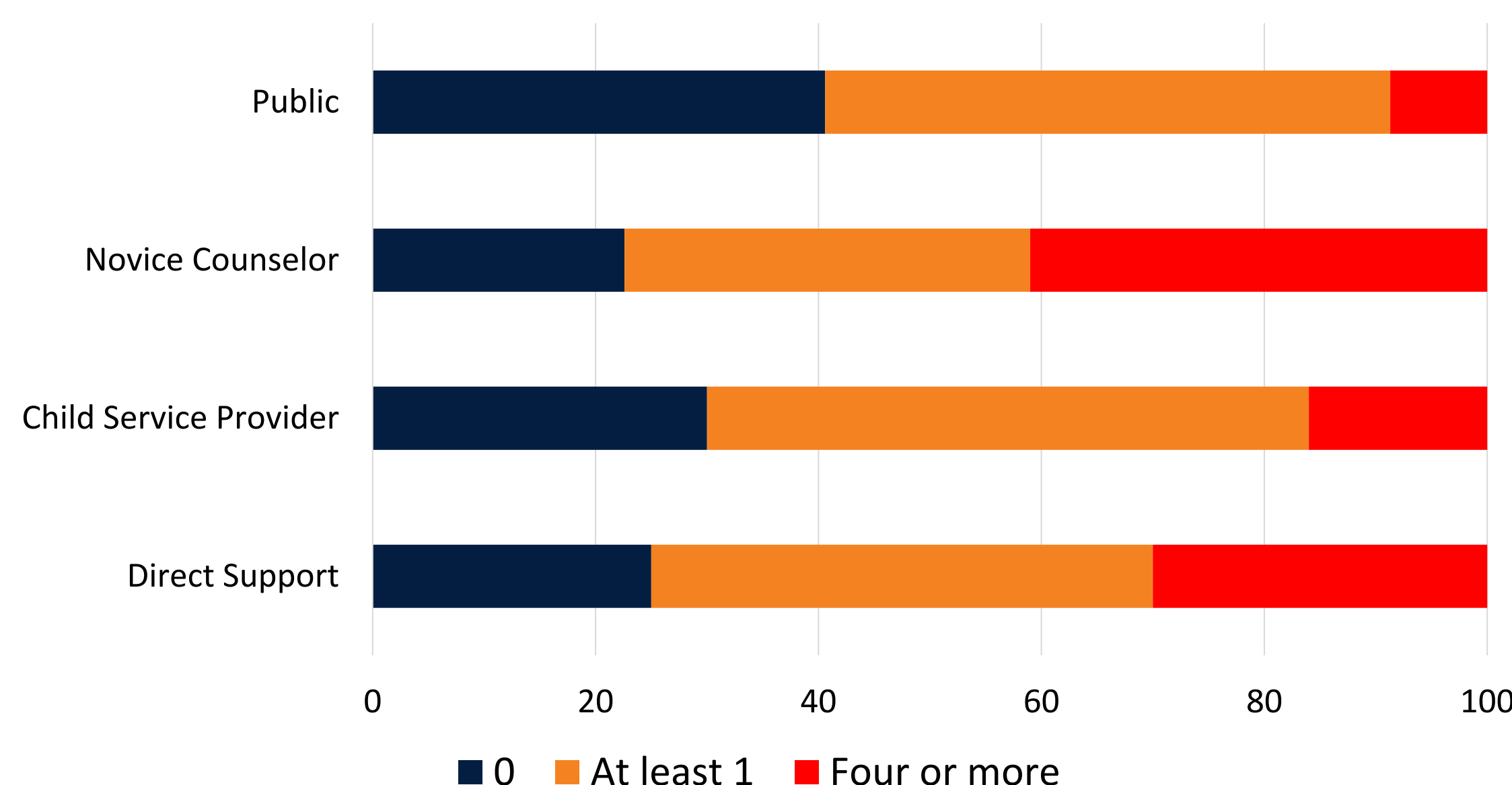
Internalized Mental Health Stigma: Self-stigma usually describes a process in which an individual with mental health concerns internalizes the stigma and then experiences diminished self-esteem and self-efficacy, limiting prospects for recovery (Rossler, 2016).

Latinx/Latino/Latina/Hispanic: Hispanic and Latino are often used interchangeably but they mean two different things. Hispanic refers to people who speak Spanish or are descended from Spanish-speaking populations, while **Latino** refers to people who are from or descended from people from Latin America.

Previous Evidence of Wounded Healers

- ✓ 75% of counselors and psychotherapists have experienced emotional or psychic wounds, which led them to their careers (Fear, 2022).
- ✓ Among faculties and graduate students who are in clinical, counseling, and school psychology, **more than 80%** respondents reported a lifetime history mental-health difficulties, and **nearly half (48%)** reported a **diagnosed** mental disorder (Victor et al., 2022).

Adverse Childhood Experiences



(Bynum et al., 2010; Esaki & Larkin, 2013; Keesler, 2018; Han & Carrola, in-press)

Objectives

Gaps

- ✓ Stigma itself is a culturally defined construct since it is derived from shared attitudes held by individuals within a culture (Abdullah & Brown, 2011).
- ✓ There have been a few studies investigating mental health stigma in Latino population, but studies comparing the level of stigma across cultures have inconsistent results (Corrigan & Watson, 2007; Parcesepe & Cabassa, 2013).
- ✓ Moreover, Latino counselors-in-training with mental health concerns (i.e., Latino wounded healers) have not been investigated, as of our knowledge.

Current Study

Aims to investigate the prevalence of mental health illness and the level of mental health stigma among the Latino population and the relationship between mental health stigma with other significant constructs including psychological distress and cultural values.

- Specifically, two specific research questions guided the study:
 - (1) to examine whether Latino counselors-in-training would have a higher prevalence of mental illness compared to other Latino graduate students and
 - (2) to test whether cultural values predict mental health stigma among Latino graduate students.

Methodology

After UTEP IRB approval, cross-sectional data were collected by surveys.

Participants

164 graduate students who identify as (1) Latino and (2) attend the UTEP

Measurements

- ✓ Demographic questionnaire
- ✓ Kessler Psychological Distress Scale (K-10) for psychological distress
- ✓ Cultural Values Scale (CVSCALE)
 - (1) Power Distance, (2) Uncertainty avoidance, (3) Collectivism, (4) Masculinity, and (5) Long-term orientation
- ✓ Internalized Stigma of Mental Illness (ISMI) scales
 - (1) Alienation, (2) Stereotype Endorsement, (3) Discrimination Experience, (4) Social Withdrawal, and (5) Stigma resistance

Data Analysis

The data were analyzed via t-test and regression using SPSS

Significance

Implications

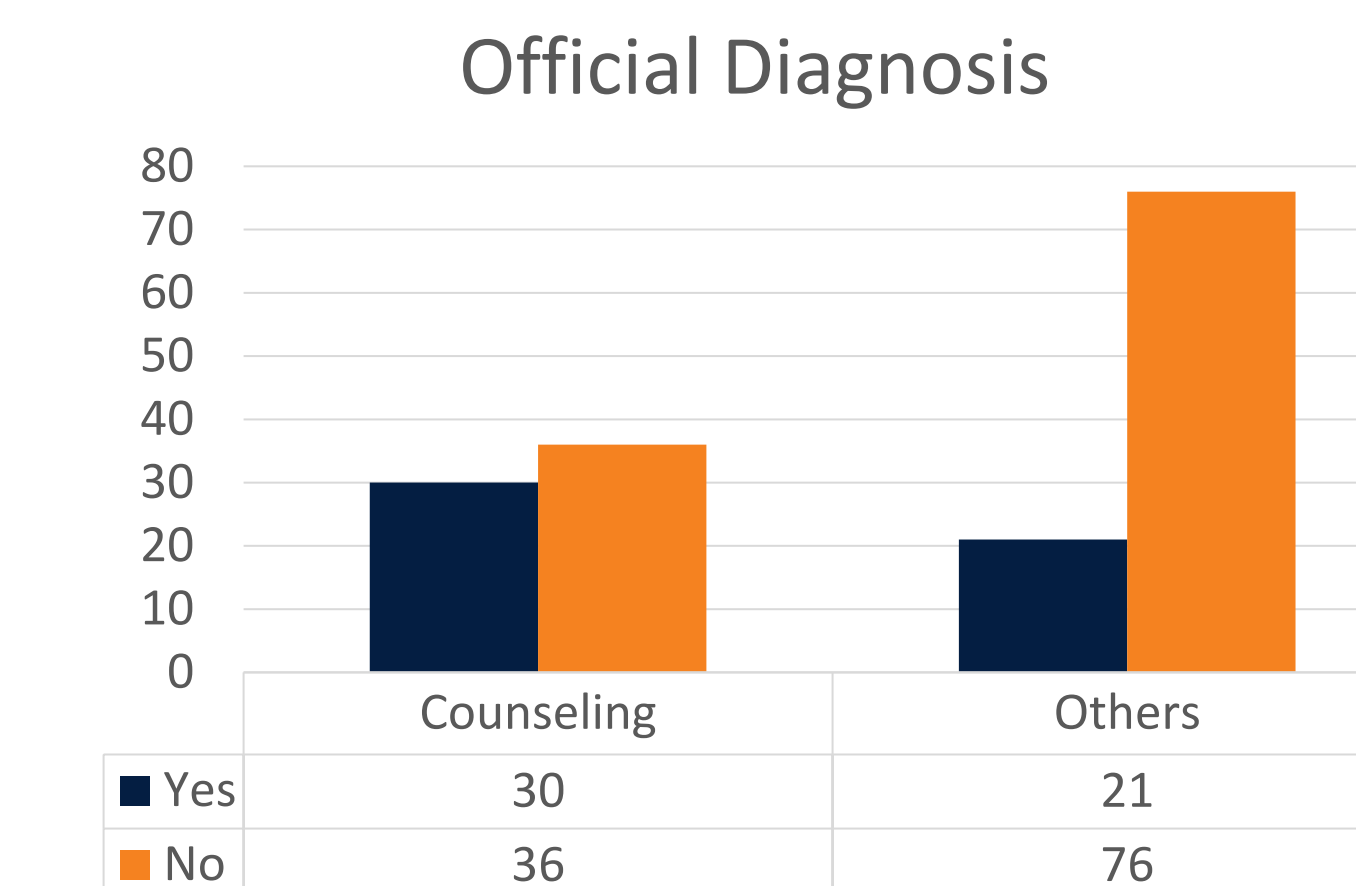
Increased need to better understand for preparing Latino counselors-in-training due to (1) an increase of Spanish-speaking clients and immigrants in the U.S., and (2) multicultural and social justice counselor education.

Limitations

- ✓ Identification issue
- ✓ Convenient sampling from one Hispanic-serving Institution
- ✓ Self-report survey: social desirability issue
- ✓ Being mindful of stigma: some items of the ISMI scale are worded with the presumption of mental illness.

Results

1. Latino counselors-in-training reported **more having official mental health diagnoses** compared to other Latino graduate students ($\Phi = .25, p < .01$).



However, there were **no** significant differences in psychological distress, cultural values, and internalized mental health stigma between Latino counselors-in-training and other Latino graduate students ($p \geq .01$).

2. Internalized mental health stigma among Latino graduate students was predicted by several variables.

2-1. Psychological distress predicted internalized mental health stigma ($\beta = .32, p < .01$). Specifically, we expected that .32 increase in internalized mental health stigma per one unit increase in psychological distress score.

2-2. With the level of other variables controlled, the three variables predicted internalized mental health stigma as follows: (1) Psychological distress ($\beta = .30, p < .01$), (2) Power distance ($\beta = .22, p < .01$), and (3) Long-term orientation ($\beta = -.24, p < .01$).

Specifically, **Long-term orientation** negatively predicted the internalized mental health stigma, which means we expect that .22 **decrease** in internalized mental health stigma per one unit increase in Long-term orientation.

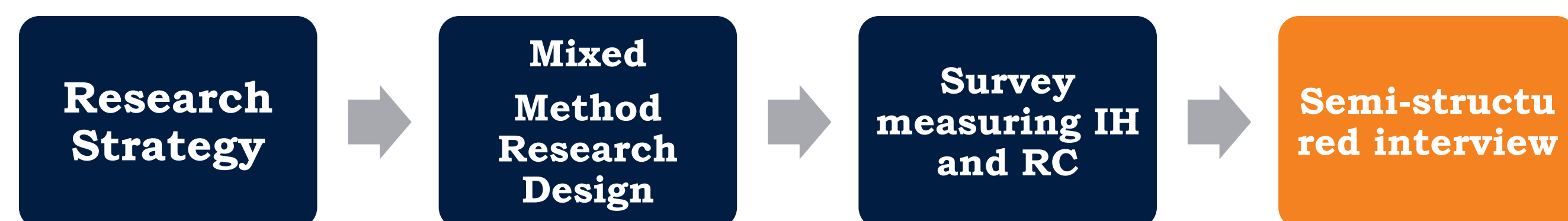
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Presentation Context



Research question: How do engineering students conceptualize and value intellectual humility?

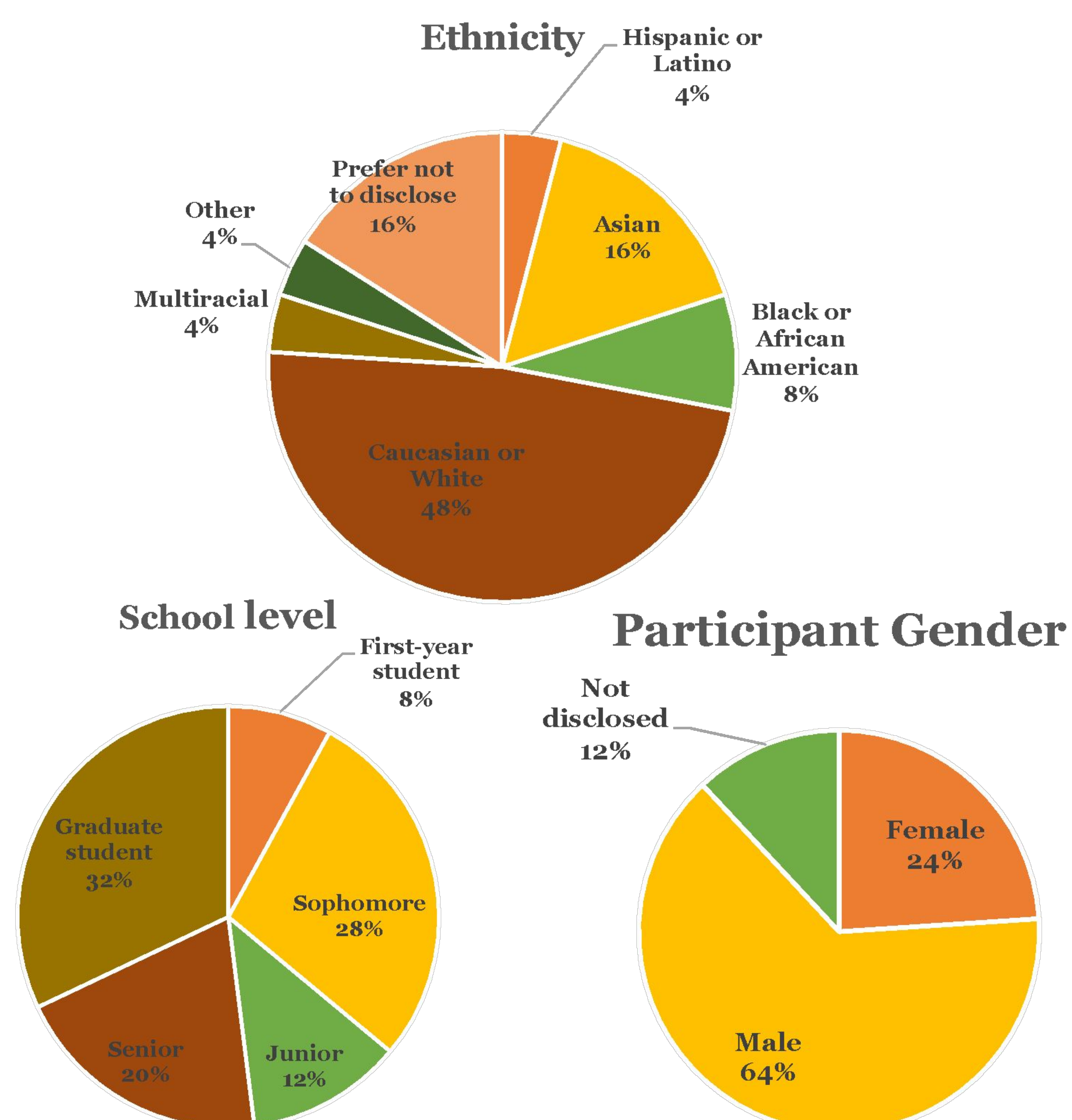
Purpose: Present **qualitative results** on intellectual humility and resistance to change through resulting themes and categories.

Introduction

Abstract:

- Existing research shows that intellectual humility (IH) is positively associated with academic performance in post-secondary education (Wong & Wong, 2021).
- IH has direct influence on how individuals process new information, remain open, change their conceptual understanding, and learn new competencies (Samuelson et al., 2015).
- Prior research in engineering has shown that undergraduate students carry high levels of cognitive rigidity and of emotional attachment to their own ideas (Dyehouse et al., 2015).

Student Demographics



Methodology

- A semi-structured interview protocol was employed to ask questions derived from theoretical constructs in the literature on intellectual humility and resistance to change.
- At the end of a survey, participants were asked if they wanted to participate in a follow-up interview. The interview study is based on **25 interviews**.
- We followed an iterative process of open and axial coding followed by interrater reliability checks producing commonalities and divergence.
- For the analysis of the range of conceptualizations, the research team chose a phenomenographic approach (Åkerlind, 2008).
- For eliciting commonalities, the research team utilized phenomenological research approaches (Vagle, 2018).

Results: Intellectual Humility

(a) Definitions and conceptualizations of humility,

Anti-definitions:

Not bragging (Angel, Pos. 159); *Not attaching yourself to your idea* (Nathan, Pos. 109); *not thinking like you're better than someone* (Wesley, Pos. 81); *not trying ... to put someone else's opinion or perspective down* (Fatima, Pos. 97); *snobby* (Andrew, Pos. 145); *absence of intellectual pomposness* (Ben, Pos. 101); *not comparing yourself to anyone* (Angel, Pos. 163).

(b) Students' personal values of humility and the value placed on humility by universities as experienced by engineering students,

'I would love for me to be intellectually humble. And that is the way that I would want for myself to be as' (Sean, Pos. 113).

'I don't know that you can fit that to most of the core classes, like computer networks. There's not like open ended debate stuff there. It's just kind of, here's how it works' (Nathan, Pos. 147).

And the organization, they're going to be there for years, if they say the entire time. So how they act is more important. And also, you're more rewarded within an organization rather than in a classroom (Ryan, Pos. 85).

(c) Observable characteristics and personality traits of intellectually humble peers and faculty.

(d) The perceived value of humility in the profession students prepare for,

Results: Resistance to change

Routine seeking:

- Instant feelings of frustration and annoyance.
- Students' carry a busy schedule
- Students' belief about their role as students

'[assignments] just comes with it. That's just part of the coursework' (Marcus, Pos. 221).

iv. Time management

'Yeah, personally, yes, it is very hard. I live on plans. I have a plan to do today. I have planned what to do tomorrow. I have planned what to do next week. It's already there' (Ahmed, Pos. 169)

(b) Emotional reaction to imposed change:

- Students will still follow new instructions even though they reacted negatively to sudden change.

'So I would figure out a way to make it work, even if it wouldn't necessarily be something I'd be super happy about' (Wesley, Pos. 157).

- Students react negatively to sudden changes
- Student and professor relationship

I would like ask my classmates about it. And if my classmates who are complaining then I would ask that we like all like, talk to the like teacher or professor about like an extension on the due date (Angel, Pos. 235).

(c) Cognitive rigidity

- Closed-mindedness and lack of will to adjust to new situations.
- When it comes to students changing their mind, they look for certainty which becomes a depending factor.
- The reason students change their mind is related to knowledge.

Final insights

- Intellectual humility (IH) can be seen as a skill that aids students process new information.
- Engineering students see resistance to change as a lack of IH, when students are not open to new ideas, suggestions, and peers' opinions.
- College can play an important role in creating spaces where students can excel in IH.

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Becoming a Bilingual Teacher on the Border: Developing Ideological Clarity at a Hispanic-Serving Institution



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Overview

This qualitative case study sought to understand the opportunities that bilingual preservice teachers (PSTs) at a border city Hispanic-Serving Institution (HSI) have to develop linguistic ideological clarity during their time in a teacher education program, as well as the ways their own linguistic histories might interact with the language ideologies in circulation and development within the program. Findings included PSTs reframing their bilingualism through a heteroglossic lens; conceptualizing “success” in linguistic terms; and specific pedagogies within teacher education that provided opportunities for the development of ideological clarity.

Background

- U.S. classrooms are growing increasingly more diverse.
- Integral role of developing ideological clarity among PSTs who will work with linguistically diverse populations
- *Ideological clarity*: An ongoing process through which individuals can critically consider their ideological orientations as well as dominant ideologies that favor those in power, with an aim of becoming agents of change (Alfaro & Bartolomé, 2017).
- In border communities, teacher educators prepare a population of future teachers that has often experienced academic, linguistic, and social situations similar to those of their future students but different from much of the nation.

Findings

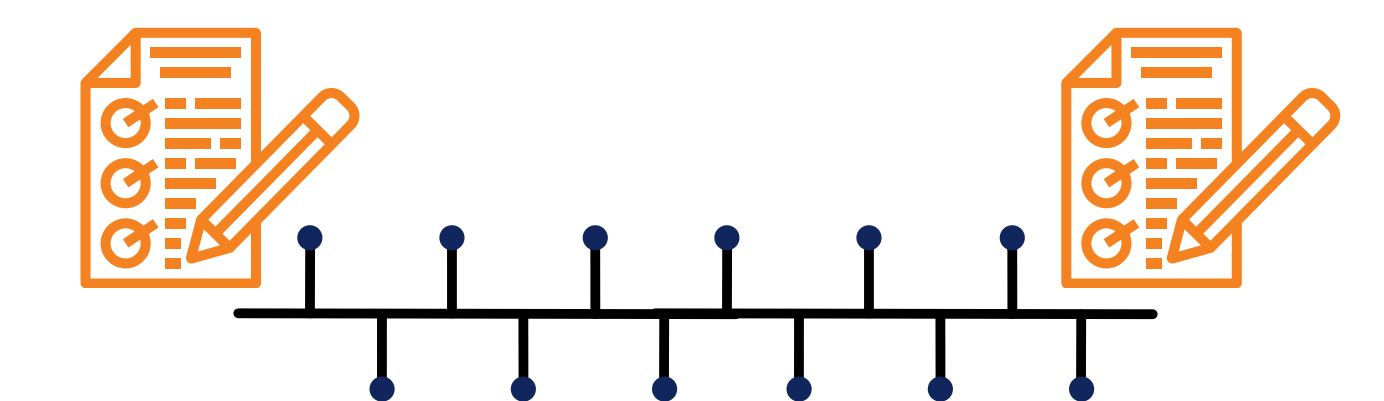
1 Reframing bilingualism

- PSTs experienced monoglossic framings of their bilingualism during K-12 schooling.
- For many, this led to a transition towards favoring English over Spanish.
- During the introductory BED course, PSTs had opportunities to reframe their understandings of bilingualism towards a more heteroglossic conceptualization.
- This occurred through interaction with course content and opportunities to use Spanish in an academic setting.



2 Success as a language ideology

- PSTs were defined as successful (or not) via standardized testing at two points in their trajectories towards becoming bilingual teachers.
- Standardized tests defined their success as bilinguals during K-12 school, which drove many towards English-only school experiences.
- Despite opportunities to reconceptualize bilingualism, their success was again defined by the BTLPT during their residency.
- This framing meant that bilingual PSTs were defined as successful by monoglossic ideologies.



3 Pedagogies for developing ideological clarity

The instructor of an introductory BED course used 3 centering practices to ground course content and help students consider topics from a critical perspective. These practices included the following:

- helping PSTs *historicize* their own identities and experiences as well as those of multilingual students in general
- encouraging PSTs to *interrogate the power* at work in policies, perspectives, and experiences
- providing opportunities for PSTs to engage in *praxis* through critical reflection and application



- The instructor also used *libros acompañantes* as a platform to connect theoretical content to practical application.
- These critical multilingual children’s books provided PSTs with platforms through which to notice and name the ideologies at work in their own histories and in educational settings, and move towards reflecting on and applying new understandings in practice.

Methodology

Qualitative case study

Participants:



4 PST teacher residents



6 PSTs enrolled in introductory BED course



1 instructor of introductory BED course

Data Sources:



22 interviews



30 hours observations in BED course



92 samples of course artifacts

Data Analysis:

- Multiple rounds of open and focused coding to move from codes to categories to themes (Saldaña, 2016)

Context:

- Border city Hispanic Serving Institution (HSI)
- Majority of PSTs grow up in the borderland context and return to teach in schools in the same community (Sloat et al., 2007)
- First semester in which introductory BED course was promoted as taught in Spanish for bilingual certification PSTs

Conceptual Framework

- Language ideologies: Systems of beliefs about languages and those who use languages in different ways and social contexts (Woolard, 1998).
- Ideological clarity: Ongoing process through which individuals can critically consider their ideological orientations as well as dominant ideologies that favor those in power, with an aim of becoming agents of change (Alfaro & Bartolomé, 2017)
- Dynamic bilingualism: Accounts for the ways in which languages are socially constructed and posits that the languages of bilinguals exist in a single linguistic repertoire (García, 2009). This conceptualization is particularly important to the borderland context of this study.
- Empirical work shows influence of teachers’ linguistic histories on language ideologies that later circulate in classrooms (e.g. Briceño, 2018; Ek et al., 2013).
- Monoglossic ideologies and ideologies of language standardization are evident in the ways standardized testing has come to define success, particularly for bilingual students in border communities (e.g. Bach 2020; Henderson, 2017).
- In teacher education programs, pedagogies such as interrogating personal experiences and the use of critical multilingual texts can aid in the process of developing ideological clarity among PSTs (e.g. España & Herrera, 2020; Ostorga & Farrugio, 2020).

Discussion and Implications

- Importance of providing PSTs with opportunities to reflect on linguistic histories as an integral initial part of the process of developing ideological clarity
- Teacher education programs preparing bilingual PSTs to take the BTLPT: Practical and ideological preparation is necessary. From a wider lens, it is important for policy-makers to be aware of the longer-term effects of K-12 standardized testing with a goal of exiting students from bilingual education, which may unintentionally push future bilingual PSTs out of the pipeline.
- Developing ideological clarity is a process, not an endpoint. The pedagogies observed in this study may be considered for revisions of teacher education course syllabi as a step towards improving PSTs’ preparation.

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A scoping review of research on early childhood educators and the teaching of spatial reasoning

Background

Little research has been done to investigate how early childhood educators (ECEs) teach spatial reasoning (SR) through mathematics. This scoping review describes what is known about ECEs teaching or learning to teach SR by synthesizing extant literature related to teachers' professional development, their tools, and their knowledge and beliefs about teaching SR. Situated learning theory and sociocultural theories of learning informed the alignment of the literature to factors within an adapted model of teacher professional growth, in which components are conjectured to relate to teaching practices. Results indicate that ECEs' SR knowledge is researched most frequently, while few studies illustrate what SR teaching practices look like in the early grades.

Methods

Systematic Review of Extant Literature

	Identification of studies via databases and registers	Identification of studies via other methods
Identification	Records identified from: Databases (n = 371)	Records identified from: Ancestral citation search (n = 34) Forward search (n = 3)
	Records removed before screening: Duplicate records removed (n = 152)	Records excluded by reason: (Not teacher focused, n = 30) (Students over PK-2, n = 35) (Not SR focused, n = 18) (Not empirical, n = 18)
Screening	Records screened (n = 219)	Full texts excluded by reason: (Child focus, n = 7) (Content area, n = 6) (Grade level, n = 9) (Not empirical, n = 7) (Teacher knowledge or practice, n = 11) (Other – population, test development, n = 2)
	Full texts assessed for eligibility (n = 58) Retained (n = 21)	Reports assessed for eligibility (n = 37) Retained (n = 8)
Included	Studies included in review (n = 29)	Reports excluded by reason: (Child focus, n = 7) (Content area, n = 6) (Grade level, n = 5) (Not empirical, n = 10) (Other – gender focus, n = 1)

Note. From Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. *BMJ* 2021;372:n71. doi: 10.1136/bmj.n71. For more information, visit: <http://www.prisma-statement.org/>

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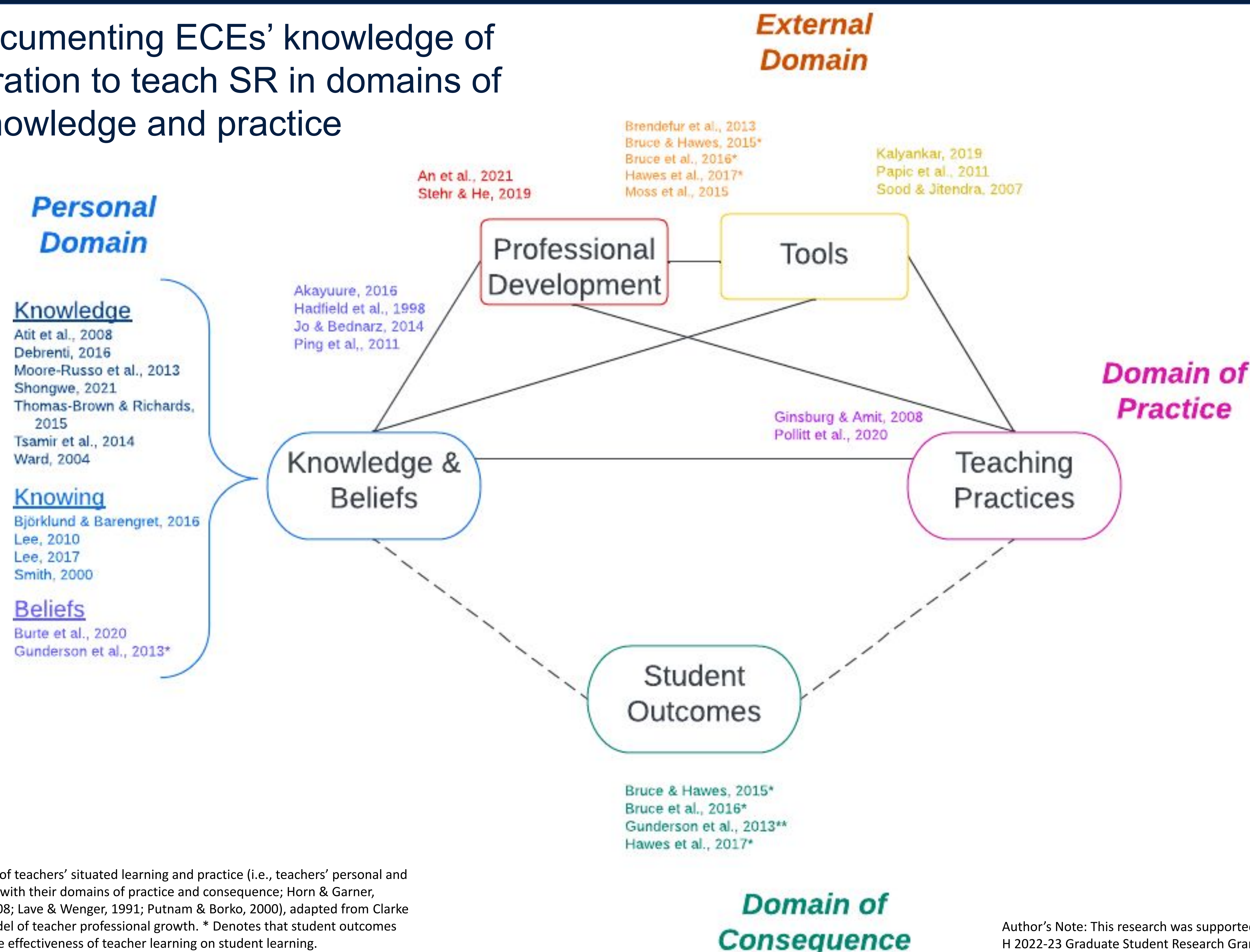
Extra results

This paper contributes to mathematics education research as evidence that we currently know little about how ECEs teach and learn to teach SR through mathematics. These findings support earlier claims that SR is not taught with the necessary emphasis (Clements & Sarama, 2011) and illuminate gaps in the extant research related to PD, tools, knowledge, and beliefs. Future research directions include spatializing early mathematics curricula, developing PD for ECEs to engage in collaborative situated learning, and enhancing ECEs' SR teaching practices by developing positive mathematical identities.

SR should be taught in early grades classrooms, but numeracy instruction continues to dominate young children's learning opportunities (Bruce et al., 2012; Clements & Sarama, 2011; Copley, 2010). This synthesis indicates that we know little about what SR instruction looks like and therefore need to learn how SR is currently understood and taught by ECEs to develop ways to spatialize early mathematics teaching practices. Sharing these findings will facilitate researchers in articulating their impetus to develop curricula and PD to enhance SR instruction.

Spatial reasoning is critical to mathematics and STEM learning. Early childhood educators are rarely prepared to teach its comprising skills.

Studies documenting ECEs' knowledge of and preparation to teach SR in domains of situated knowledge and practice



Note. Proposed components of teachers' situated learning and practice (i.e., teachers' personal and external domains interacting with their domains of practice and consequence; Horn & Garner, 2022; Kazemi & Hubbard, 2008; Lave & Wenger, 1991; Putnam & Borko, 2000), adapted from Clarke & Hollingsworth's (2002) model of teacher professional growth. * Denotes that student outcomes were reported to describe the effectiveness of teacher learning on student learning.

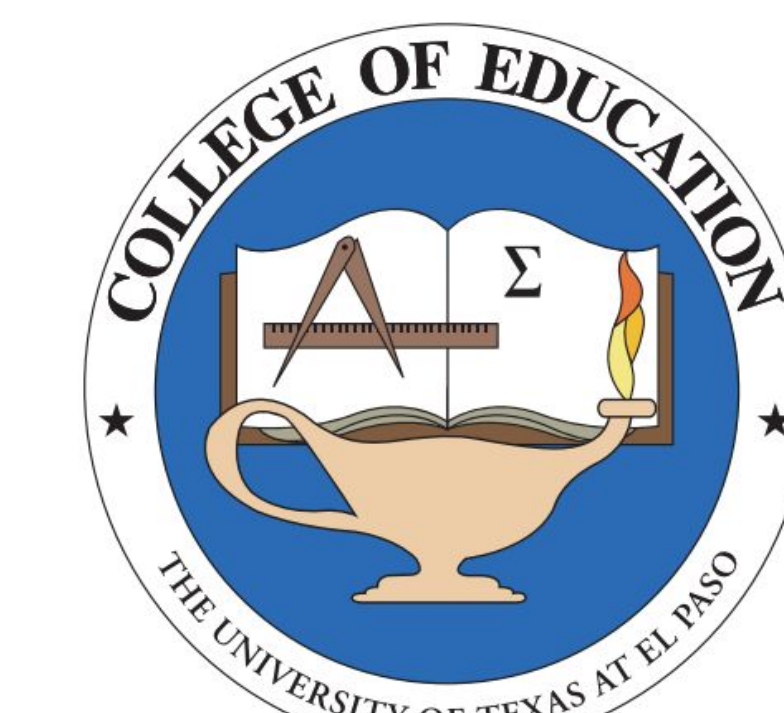
Author's Note: This research was supported by the AERA Division H 2022-23 Graduate Student Research Grant Program.



Transfronterizo Families' Languages Policies at the U.S.-México Border

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Introduction

Many Latinx and immigrant families know that to navigate in this country, their children need to learn English even though they also want them to maintain their heritage language (HL). This research is a qualitative, multiple-case study, that looks at the decisions parents make about their language use at home. Particularly, it focuses on the language practices at home of transfronterizo families, those families who are frequent border crossers.

This research is currently in the data collection stage.

Background

Many language minority parents in the U.S. view bilingualism as a family goal and aim to provide their children with the opportunity to learn a second language at a young age (King & Fogle, 2006). Schools in the U.S. have a deficit way of thinking which views minority students and their families at fault for poor academic performance, which claims that students enter school without cultural knowledge and skills and that parents do not value or support their children's education (Yosso, 2005).

The exploration of the language use and decision-making practices taken by Latinx, and immigrant parents can be explained by the understanding of the development of family language policy (FLP) which is seen as an action taken by parents to provide support for children's HL maintenance and development. However, the support that parents provide for their children, is not viewed as a contribution to what happens in the classroom. FLP is shaped by what the family believes will strengthen the family's language goals (Curdt-Christiansen, 2009). Soltero-González and Reyes (2012) emphasizes the importance of building on the language and cultural resources children bring from home into the classroom to support English language and literacy development.

Looking at FLP is significant for the Latinx and immigrant student population, as is the practice that centers around what the family believes is better for their children's language acquisition and practices when it comes to learning a second language. There is research on the FLP of immigrant children in the U.S. schools, however, it is not particularly focused on the FLP of transfronterizo children on the border.

Significance

I want this research to bring light to the language policies that happen within the homes of transfronterizo families when it comes to their children's upbringing and how those policies are connected to their experiences as transfronterizo families living in the U.S-Mexico border.

I expect through this research, to inform policymakers and educators, about the language practices already in place in transfronterizo homes to better understand and utilize this information towards improving the instruction and classroom experiences of transfronterizo students. Potentially, this research could bridge the communication gap between transfronterizo parents, educators, and school administrators.

Research Questions

1. How do transfronterizxs families describe their family language policies (FLP) at the U.S. Mexican borders?

- a) How are families talk about their language practices in the home?
- b) What language ideologies circulate within the family?
- c) How are families managing language use within the home?

2. How FLP connected to their experiences?

- b) How are families' FLPs connected to (influence/influenced by) children's schools?
- c) How is FLP connected to (influence/influenced by) histories of language use and ideologies in the family?
- d) How is FLP connected to (influence/influenced by) the border context and contact with multiple cultures?

Methodology

- Multiple-case study.
- Three-part, in-depth interviews (Seidman, 2006).
- Video record family interactions while focusing on their language use. Video recordings are those that happen regularly and routinely for the families.

Participant Characteristics

Participants for this study are families that meet the following characteristics:

- Parents to at least one elementary aged child who attends a public-school dual language program in the El Paso area.
- To live in the El Paso area.
- Have been born either in México or in the United States.
- Have Mexican parents.
- Have been raised in México during part of their childhood.
- Cross the border often.

Theoretical Frameworks

- **Family language policy (FLP)** as a framework to examine and understand the language policy and decisions behind what happens in the homes of transfronterizo families to achieve the desired bilingualism of the parents. It provides a lens that allows to examine the linguistic practices at home while examining the participants' perceptions of their language policy regarding their beliefs, management, and practices.
- King and Fogle (2013) describe FLP as a policy that considers what families do with language in day-to-day interactions, their beliefs and ideologies about language and its use, and their goals and efforts to shape language use and learning outcomes.
- **Borderlands theory** can provide a lens to understand the perceptions of transfronterizo participants who live in between two countries, navigate two social systems, two cultures, and who speak and maintain two languages. It provides a particular lens to the study of transfronterizo families' language policies emerging from two spaces.
- Anzaldúa (1987) establishes the border between the U.S. and México, as a metaphor for all types of crossings necessary to exist in multiple linguistic and cultural contexts.

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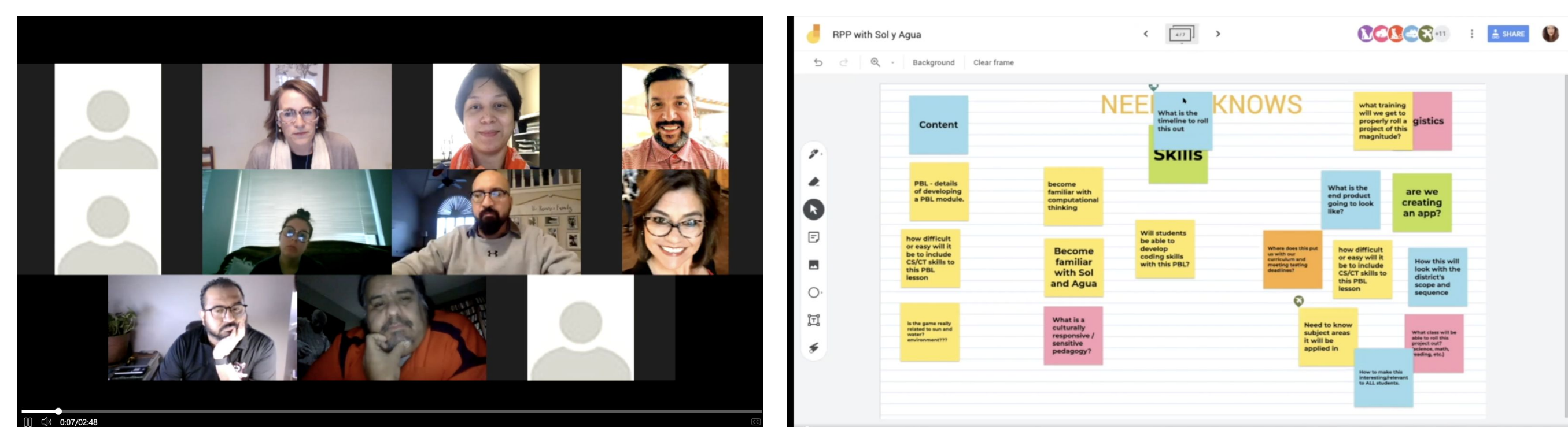
Sol y Agua: Developing bilingual, culturally sustaining curriculum for teaching computational thinking in borderland middle schools



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Overview

The Sol y Agua research-practice partnership between UTEP and the El Paso Independent School District aims to increase the number of Latinx students, emergent bilingual learners, and girls participating in computer science (CS) education through integration of computational thinking (Grover & Pea, 2013) into middle school content-area instruction, culturally responsive and translanguaging pedagogies, and co-designed lesson modules using the Sol y Agua game, a bilingual and culturally responsive video game designed by UTEP CS students to resonate with borderland K-12 students' lived experiences. Over 4 years, the Sol y Agua team collaboratively designed and piloted bilingual, culturally responsive lessons for middle school math, social studies, and English language arts classrooms. The project brings together scholarship in bilingual education and computer science education and draws on the bilingual and bicultural knowledge of team members and EPISD students to design computational thinking lessons centered on the US-Mexico borderland experience.



The Sol y Agua RPP in the US-Mexico borderland

The research-practice partnership team included 15 members with varied institutional roles (central office administrator, campus principals, instructional coaches, teachers, university researchers and doctoral and undergraduate students). Most team members identified as Hispanic or Latina/o and had deep knowledge of the two school communities involved. Frontera Middle School's student population was 99% Latinx, 98% economically disadvantaged, and 78% English learners; and Warriors Middle School was an all-girls magnet program with 77% Latinx students, 60.5% economically disadvantaged students, and 13.9% emergent bilingual students.

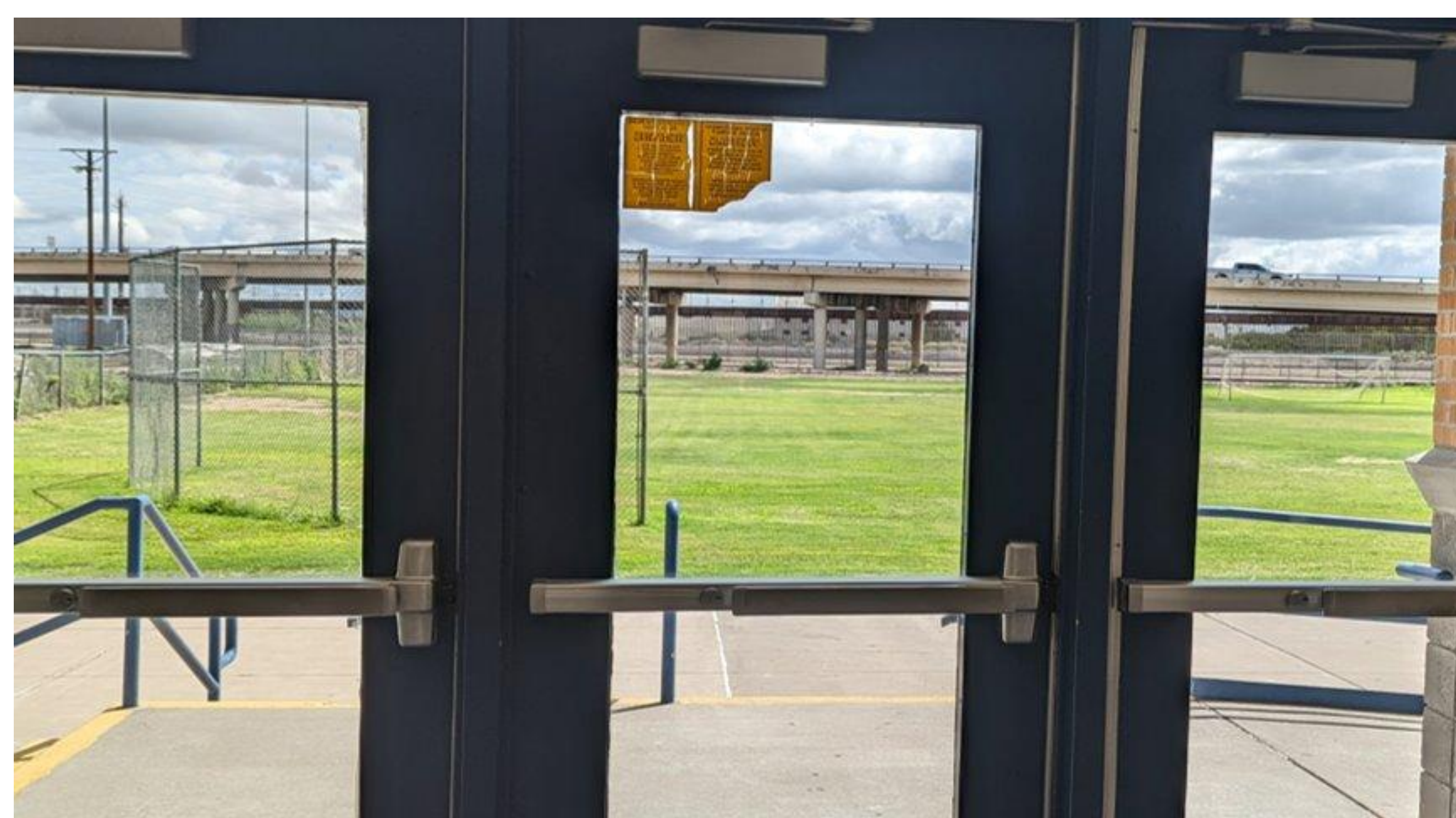
Important components of our work together included co-designing the study, co-planning curriculum development sessions, bi-weekly planning meetings, and a variety of equity-focused practices to help us develop relationships of trust. Drawing on research-practice partnership literature that identifies the characteristics of successful RPPs (Henrick et al., 2017), we aimed to cultivate a long-term relationship of mutual benefit, research a problem of practice of importance to EPISD, produce data that can inform practice, and build our collective capacity for partnership work.

Access the Sol y Agua Game: A bilingual, borderland-based game to teach computational thinking



Methodology

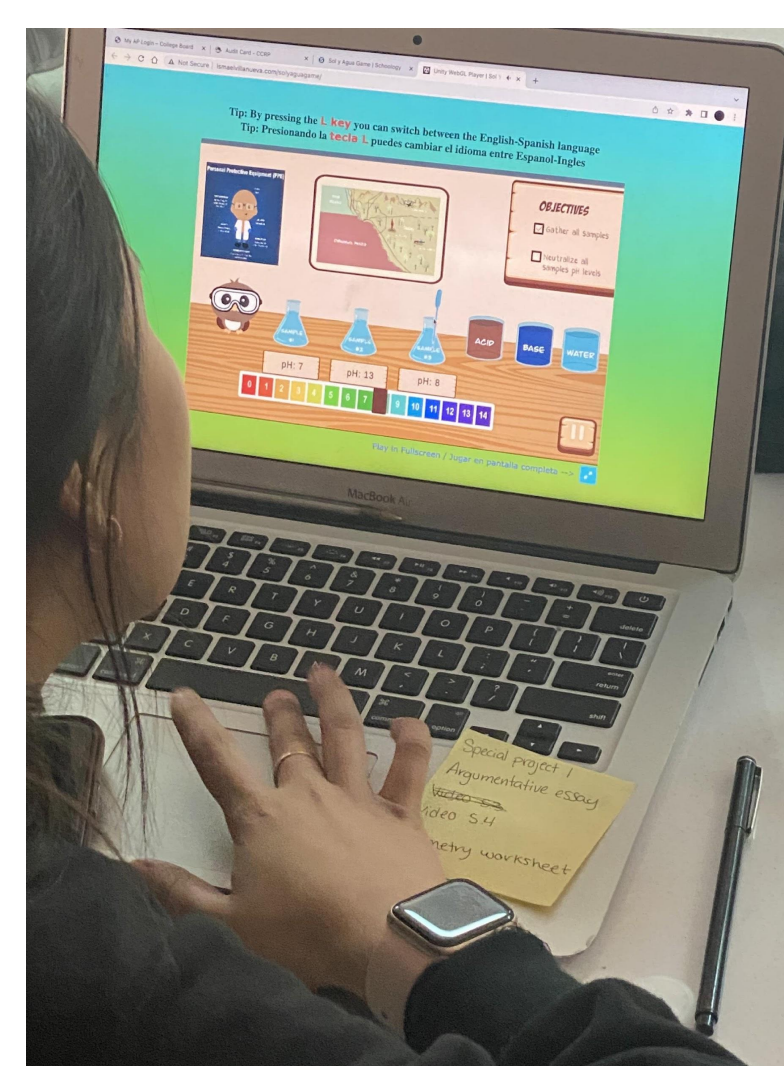
In this four-year study (October 2020-September 2023), ethnographic methods were used for data collection and analysis (Corbin & Strauss, 2014), resulting in over 70 hours of collaborative curriculum development work conducted both in-person and virtually; 37 hours of videorecorded classroom interaction; interviews with each participating teacher in 2020, 2021, and 2023; artifacts that included virtual whiteboards, draft lesson plans, and classroom handouts; and in-game usage data. Analysis included thematic coding of video and interview transcripts and artifacts using NVivo software.



Findings

Across three years of curriculum development, teachers demonstrated knowledge of computational thinking and translanguaging and culturally responsive pedagogies. In lessons piloted, teachers and students engaged in computational thinking in the context of math, social studies, and English language arts. However, CT was mostly implicit and not usually discussed explicitly.

Bringing this finding to the team, we discussed ways to make CT more explicit in revised versions of the lesson plans, as well as factors that would support more explicit treatment of CT in content-area instruction (e.g., examples of specific CT-focused instructional activities).



Products

The Sol y Agua project integrated computational thinking (CT) into middle school curricula through the development and deployment of a culturally responsive educational game. This was achieved by:

- Collaborating across disciplines, involving teachers, researchers, and students in curriculum development.
- Utilizing the Sol y Agua game to introduce CT concepts within a context familiar to students, emphasizing problem-solving, abstraction, and algorithms.
- Incorporating translanguaging and culturally responsive pedagogies to enhance engagement and learning into the planning lessons/PBLs
- Conducting iterative design and feedback sessions to refine game features and pedagogical strategies, ensuring the game supported bilingual use and aligned with educational standards.

Products include

- 5 publicly-available bilingual lesson plans/project-based learning modules and materials for all teachers in the borderland region
- Refinement of the Sol y Agua video game, incorporating feedback from teacher and student participants, and shifting to web-based play



Significance

The Sol y Agua RPP:

- Addresses underrepresentation of Latinx in computing/STEM through culturally relevant middle school curriculum
- Introduces computational thinking using innovative bilingual game reflecting local borderland environment and culture
- Emphasizes assets-based pedagogy leveraging translanguaging and students' funds of knowledge
- Provides research insights into linguistically-diverse students' computational participation for CS education
- Models equitable knowledge co-creation between universities and communities to meet educational needs
- Disrupts deficit narratives about minoritized students' capabilities by demonstrating computational strengths

Acknowledgements

This material is based upon work supported by the National Science Foundation under Grants #1923599 and #1923586. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation. This project has also been generously supported by the Hopper-Dean Center of Excellence for K-12 Computer Science Education at UTEP.



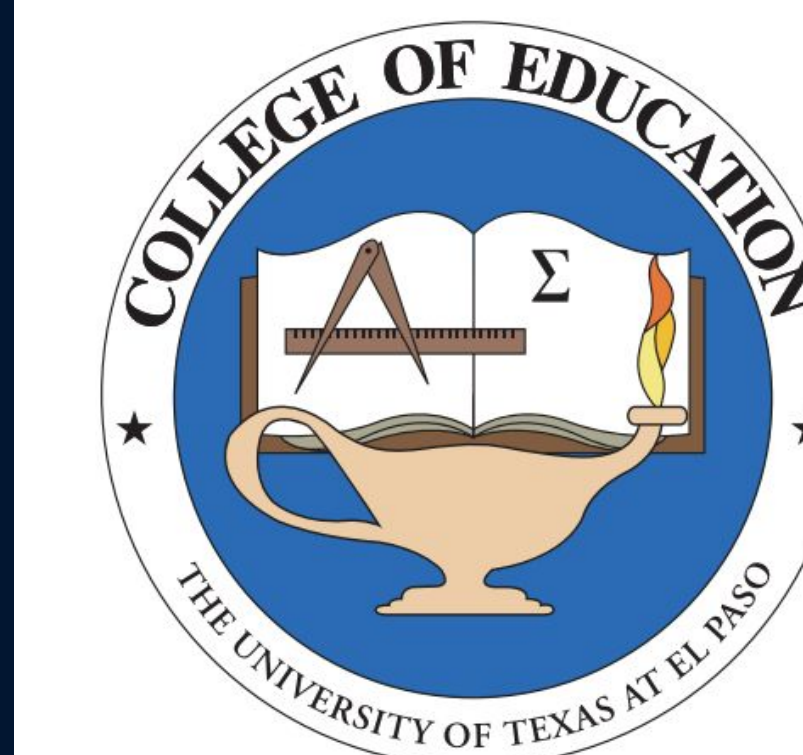


Exploring the Impact of STEM Degree Attainment on Social Mobility among Latinx Students at a Texas/Mexican Border University: A Work in Progress.

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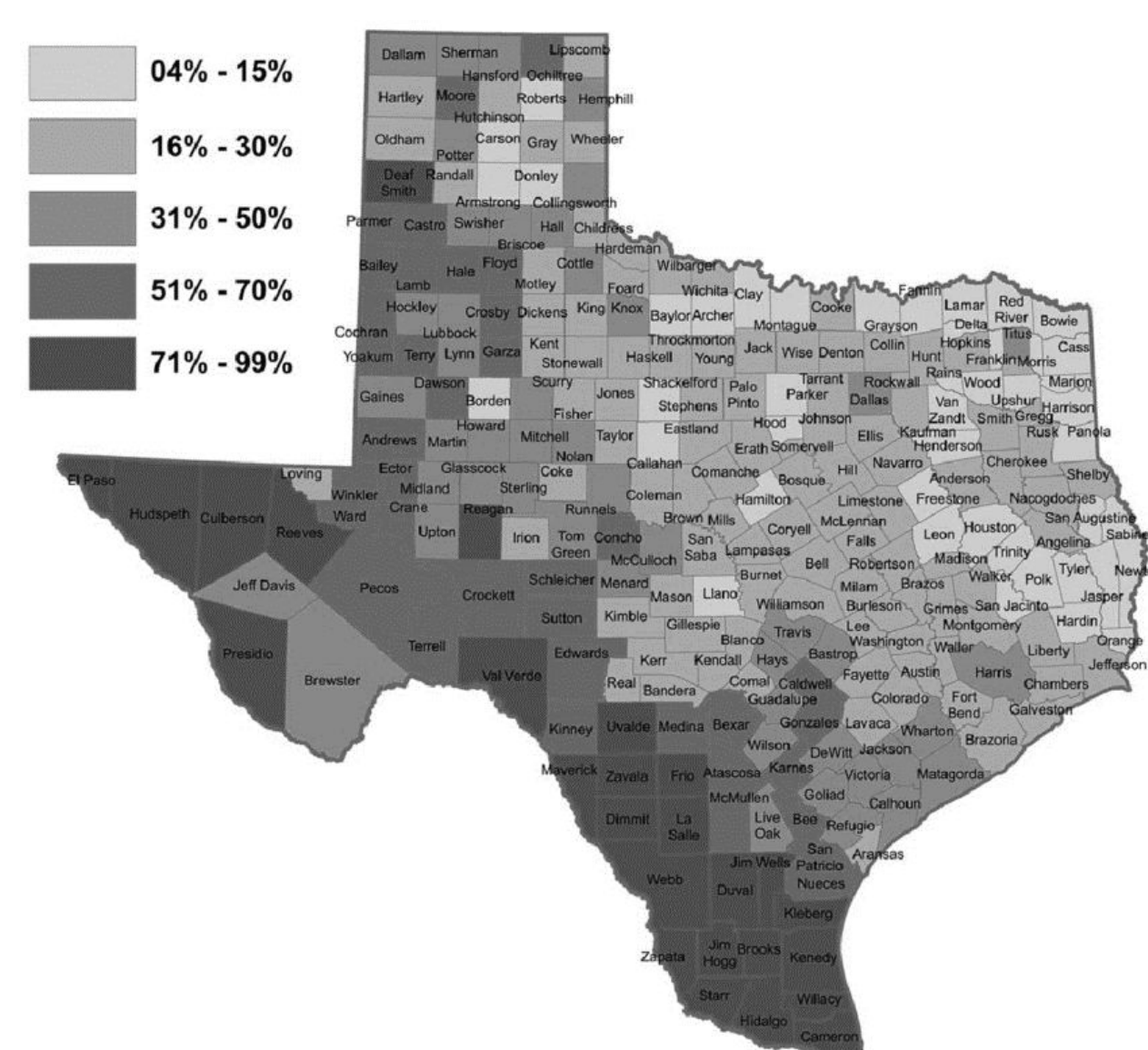
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Introduction and Background

This study aims to explore the impact of STEM degree attainment on **Social Mobility** among **Latinx** students in a **Texas/Mexican border** university.

- Some studies have been conducted on this topic; however, the specificity of Latinx higher education in STEM on the Texas-Mexico border has yet to be investigated.
- Social mobility is defined as a change in a person's socioeconomic situation, either about their parents (inter-generational mobility) or throughout their lifetime (intra-generational mobility).
- Latinx, a term fostering gender inclusivity, designates individuals of Latin American heritage living in the United States, serving as a gender-neutral alternative, acknowledging the diversity of gender identities within this community.
- The U.S.-Mexico border in Texas spans around 1,248 miles, extending from El Paso to Brownsville in the south. This region is characterized by a population where over 80% identify as Hispanic (Fig. 1).
- The **relevance** of this research addresses the need to expand and increase the ways to measure and assess higher education's social impact on the growing Latinx population. One of the goals is to better inform societal decisions and contribute to the evolution and diversification of policy-making in education.



Texas Counties and % of Hispanic/Latinx population.

Research Question(s)

The research question we look to respond to is: **How does attaining a STEM degree influence intragenerational social mobility for Latinx students in a University on the Texas/Mexican border?**

- Several studies based their research on intergenerational social mobility; this one will approach the issue through an intragenerational lens.
- This intragenerational approach will be more accurate as we compare the same individual through time rather than using datasets.



Project Methodology

Participants will complete surveys and questionnaires, and later, individual interviews and focus groups will take place to validate the quantitative results.

This research will do a **two-phased explanatory sequential mixed methods** study to obtain quantitative data and then explain the quantitative results with in-depth qualitative data. Triangulation will happen throughout the study.

- In the first phase of the study, statistical quantitative results data will be collected from a sample through a survey and followed up with the qualitative data provided from individual interviews to explain initial results in more depth.
- The strategy used to gather participants is **purposeful homogenous sampling**. This research method selects a sample with specific, similar characteristics or traits within a population.
- The **participants** in this study will be self-identified Latinx or Hispanic students (current or previous) at the University of Texas at El Paso.
- Surveys will be administered to 40 to 50 participants. This number was decided based on having a **confidence level of 95%**, with a desired margin of error of 15% (Sauro & Lewis, 2016). The data will be collected starting in the fall semester of 2024.
- The LatCrit **theoretical framework** will inform the development and interpretation of the research.

Sauro, J., & Lewis, J. R. (2016). *Quantifying the user experience: Practical statistics for user research*. Elsevier/Morgan Kaufmann.

Expected Results

- The expected results are that the attainment of a STEM degree will impact the participants' socioeconomic status (SES) as they move upward in the social mobility ladder, compared with a non-STEM degree graduate.
- STEM degree attainment has been recognized as a factor in the upward social mobility of the general population.
- This research will focus on the impact of the specific Latinx population on the Texas-Mexico border.

Median wage and salary earnings of the workforce ages 18–74 in STEM and non-STEM occupations, by sex, ethnicity, race, and disability status: 2020



NSF. (2023). Diversity and STEM: Women, Minorities, and Persons with Disabilities

Project Significance

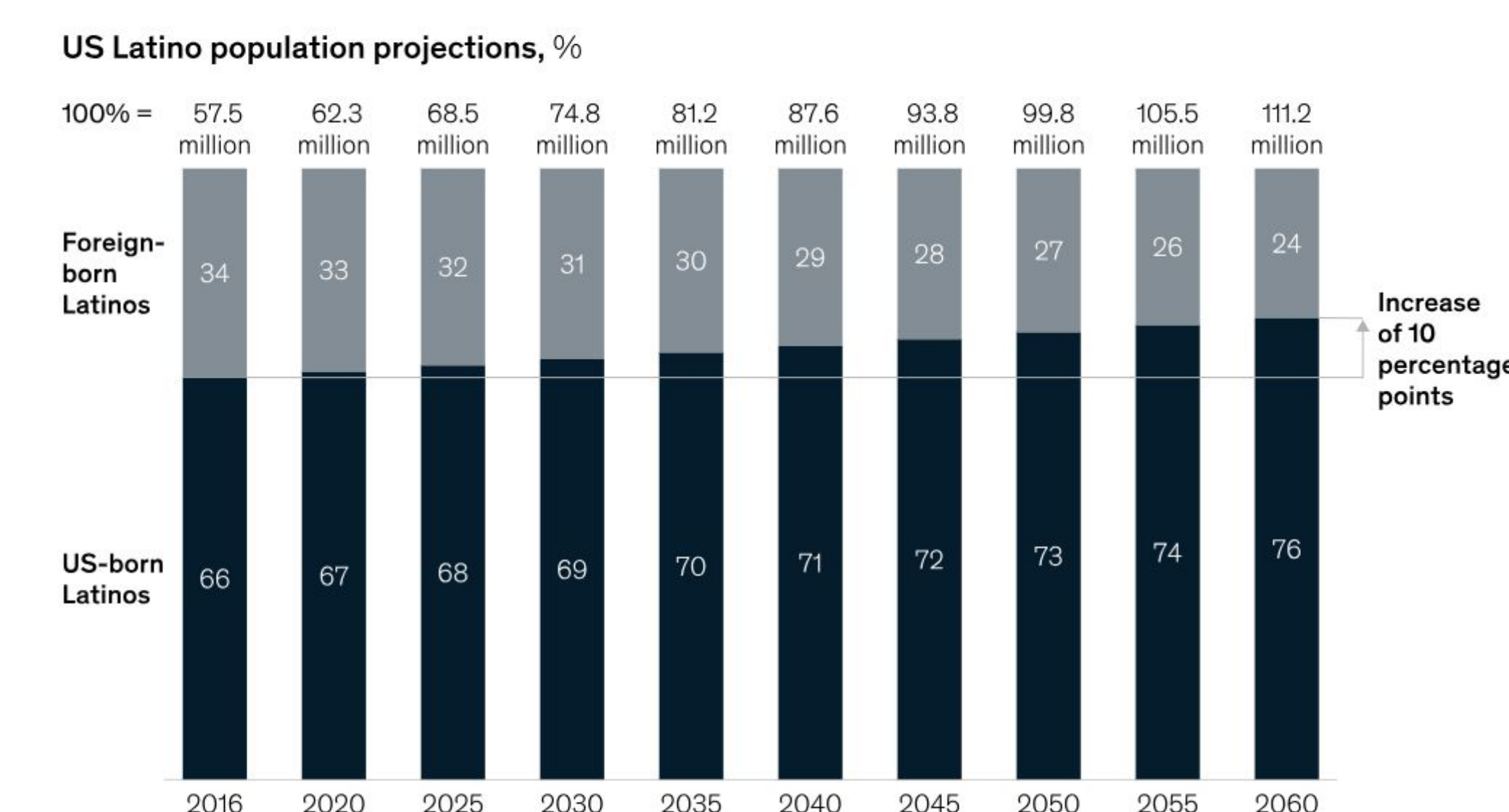
This study will contribute to the body of knowledge, adding the specificity of the impact of obtaining a STEM degree on Latinx students and their social mobility, which appears as a gap in the current literature, considering that the Latino/Hispanic population along the Rio Grande border has the largest concentration.

Sheladia, S., & Reddy, P. H. (2021). Age-related chronic diseases and Alzheimer's disease in Texas: A Hispanic focused study. *Journal of Alzheimer's Disease Reports*, 5, <https://doi.org/10.3233/ADR-200277>

Top Ten U.S. Colleges for Upward Mobility

College or University	Location	Undergrad Enrollment	Bottom 20% - Top 20% Mobility Rate
California State University	Los Angeles, CA	24,002	9.9%
Pace University	New York, NY	8,960	8.4%
State University of New York at Stony Brook	Long Island, NY	17,522	8.4%
University of Texas Rio Grande Valley*	Rio Grande Valley, TX	24,578	7.6%
City University of New York**	New York, NY	244,951	7.2%
Glendale Community College	Glendale, CA	18,176	7.1%
South Texas College	McAllen, TX	31,321	6.9%
Cal State Polytechnic	Pomona, CA	26,443	6.8%
UTEP	El Paso, TX	25,151	6.8%
St. John's University	Queens, NY	16,766	6.8%

The population of US-born Latinos is projected to grow by ten percentage points by 2060.



Source: National Population Projection Tables: Main Series, race and Hispanic origin of the native and foreign born, US Census Bureau, 2017, census.gov

Acknowledgments

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DISCLAIMER: Any opinions, findings, conclusions, or recommendations expressed in this material are those of the authors and do not necessarily reflect the views of the National Science Foundation.





Transforming the Freshman Engineering Experience through Peer-Mentorship and Professional Competency Workshops



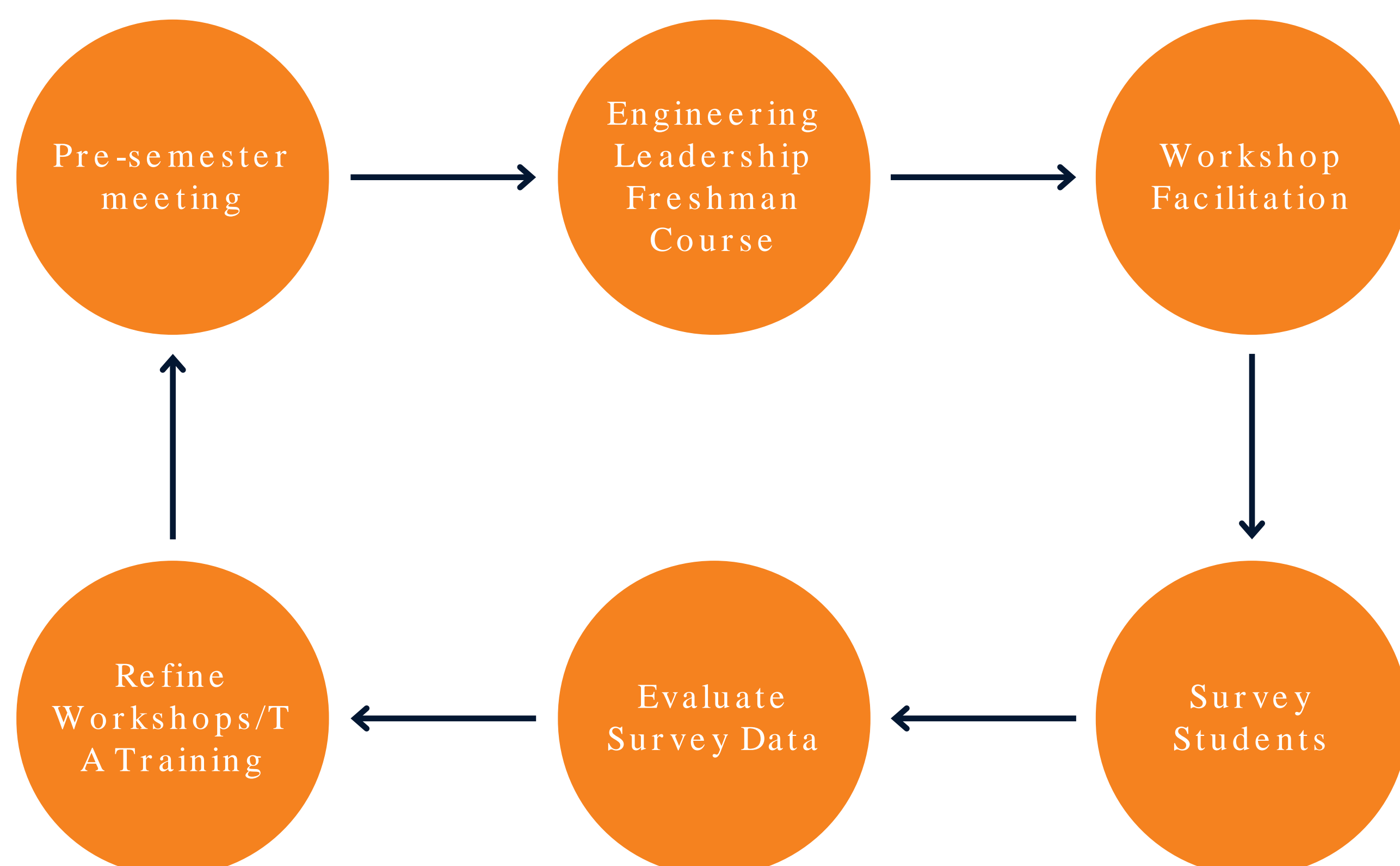
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Overview

- The goal of this study is to investigate an engineering education model that can help to transform first-year engineering students and impact their career preparedness, academic motivation, time management, communication skills, and other professional competencies
- Investigate the importance of peer-to-peer mentorship programs, specifically focusing on utilizing the course teaching assistants as role models and mentors
- The engineering profession keeps evolving, which consequently creates a need for improving current teaching and learning methods to holistically educate future engineers
- Introductory courses, regardless of academic major, play a significant role in solidifying the career preparedness, academic motivation, persistence, and foundational professional skills of undergraduate students to satisfactorily navigate their academic programs and professional careers [1][2]
- Without forgetting the importance of the fundamental technical content of an engineering curriculum, faculty must strategically revamp the curriculum to also exercise professional competencies as part of the student's learning experience [3]
- The implementation of a peer mentoring component is necessary to facilitate a support system for first-year freshman engineering students
- The Center for Research in Engineering and Technology, in collaboration with the Engineering Leadership and Innovation department, is spearheading this research initiative

Methodology

The Center for Research in Engineering and Technology, in collaboration with the Engineering Leadership and Innovation department, is spearheading this research initiative. The execution of the research follows a circular model to ensure the information given to the students is relevant. The graphic below provides an overview of the methodology used to facilitate this research initiative.



Professional Competency Workshop

We aligned the workshop content to enhance the traditional engineering content presented in the course while not compromising the curriculum. The table below provides an overview of each workshop, including descriptions and key concepts.

Workshop	Descriptions	Key Concepts
Communication	This workshop addresses the need for engineers to be able to communicate complex thoughts and ideas to diverse stakeholders and customers.	<ul style="list-style-type: none"> • Effective Communication • Conflict Management • Team Collaboration • Professional Presentation Skills • Cultural Communication • Effective Listening • Building Tailored Messages • Feedback and Improvement
Resume Writing	This workshop highlights the need to develop a resume that fits the industry expectations while also standing out to employers, scholarship boards, and other resume reviewers.	<ul style="list-style-type: none"> • Tailoring resumes for specific jobs • Format and Structure • Action Verbs • Professional Experience • Resume Review and Editing • Personal Brand in Resumes • Aligning with Employer Expectations • Continuous Improvement
Motivation and Time Management	This workshop focuses on identifying students' various motivation styles and providing strategies to hone those styles into time management practices that are sustainable for the student.	<ul style="list-style-type: none"> • Understanding Motivation • Effective Goal Setting • Proactive Time Management • Mindfulness in Time Management • Integration of Motivation into Daily Habits • Utilizing Technology to Stay Accountable • Positive Habits • Real-World Application
Get Involved on Campus	This workshop encourages students to get involved and engaged with student organizations, emphasizing the importance of extracurricular involvement to support their transition into the professional world.	<ul style="list-style-type: none"> • Benefits of Student Involvement • Identifying Student Organizations • Networking • Leadership Opportunities • Community Service • Unique Resources Access

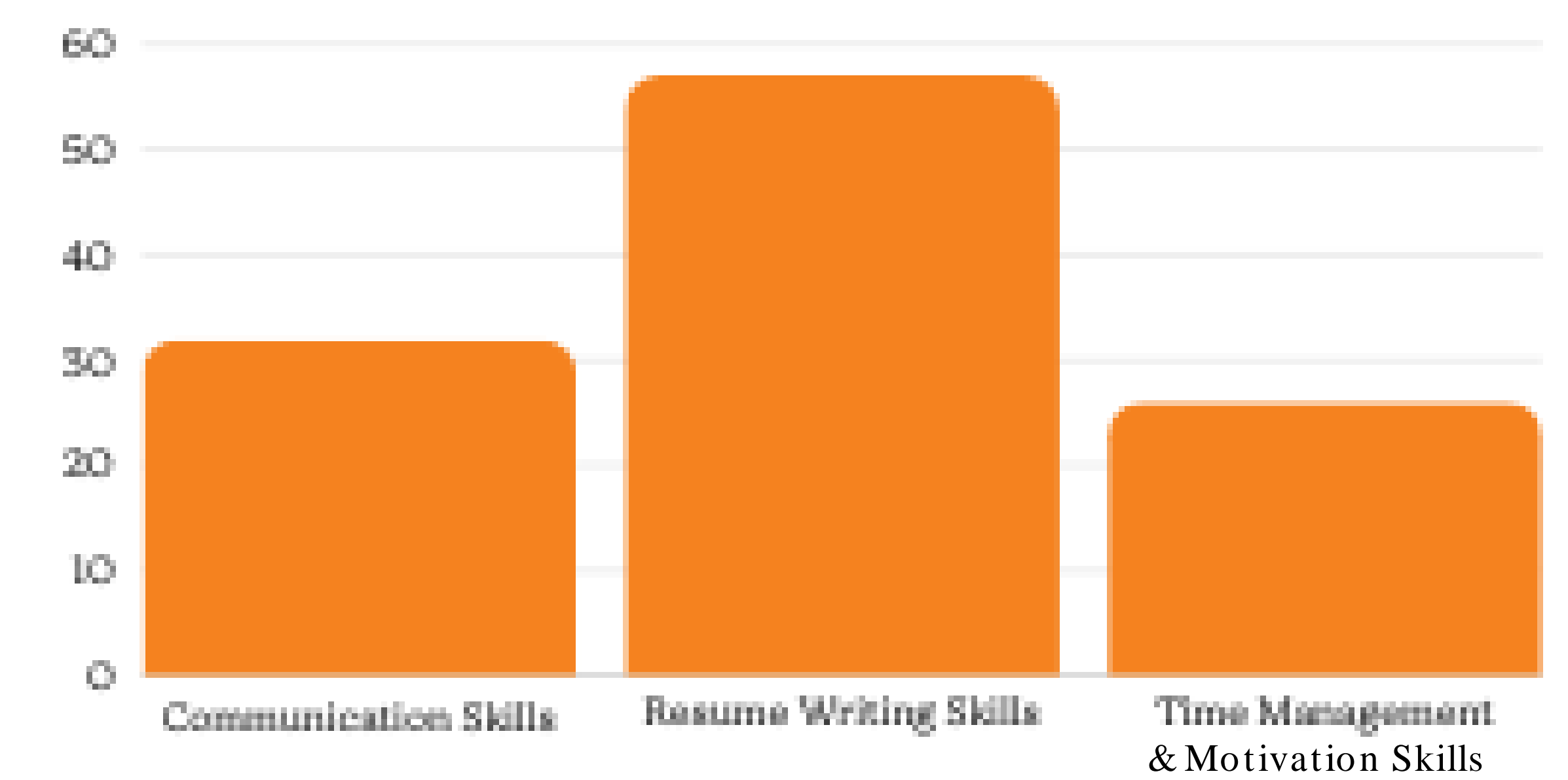
Peer-Mentorship

The professional/academic development workshop content is one part of the equation to promote student success; the other is the peer-to-peer mentorship program. The mentorship program is composed of teaching assistants fulfilling the dual role of facilitating course activities and supporting students in their professional development. The teaching assistants who have previously taken the course provide firsthand course experience and their college journey. The mentorship sessions extend beyond academic issues and stretch into career planning tips, internship/scholarship searching, promoting and modeling the professional/academic development workshop learning, and fostering an overall supportive learning environment.

Take a look at the Center for Research in Engineering and Technology Education Website!
<https://www.utep.edu/engineering/create/>

Results

To assess the impact of the professional competency workshops on students, a survey was given where students rated their confidence in applying workshop-learned skills across various scenarios. Utilizing a 5-point rating scale ranging from "Nonconfident at all" to "Extremely Confident," we measured changes in confidence level before and after the course. The table below shows the average percentage increase in students' confidence levels for each respective workshop and the skills surveyed.



Prior to the course, 95% of students were not involved on campus, with 39% of those students expressing a desire to get involved. After the course, 63% of students remained uninvolved, but 97% of these students expressed an interest in campus involvement. Additionally, only 55% of students had resumes prior to the course. After that, the number increased to 98% of students with resumes.

To evaluate the impact of the peer mentorship aspect of the program, students were surveyed regarding their interactions with their mentors. Students rated their mentors on a variety of mentoring skills and techniques. Utilizing a 7-point scale ranging from "Not Skilled At All" (1) to "Extremely Skilled" (7). The average rating across the skills techniques was 5.86, indicating a high level of satisfaction and perceived effectiveness in mentor performance.

Future Work

Moving forward, the data collection process will need to assess the student's understanding of the material and specific areas in which it is most beneficial. Additional data is needed regarding the teaching assistants and professors to determine if the additional responsibilities impacted the traditional teaching assistant duties. More data will be collected and assessed with the current state of this research project to evaluate the initial impact of the program to inform future iterations.

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Introduction

Work Integrated Learning (WIL), e.g. co-ops and internships, can play an instrumental role in helping Latinas transition from college to industry.

However, such experiences can be very challenging for Latinas as they encounter a culture that is often white, and male dominated, and not inclusive for women and minority students.

There is a growing body of literature on the experiences of women and minoritized students in STEM (Seymour & Hunter, 2019) and on Latinas in STEM (Mein et al., 2020; Villa et al., 2020), however, the body of literature on Latinas in WIL experiences in the STEM space, and in particular in the engineering space, is very limited (Kim et al., 2020; Paull et al., 2019).

In this project we explore the experiences of Latina engineering students with Work Integrated Learning, where we specifically focus on how these students experience industry work culture.

By learning more about these experiences we can work on preparing these students better for industry, and to find ways to support industry to make these engineers feel like they are valued.

Relevance

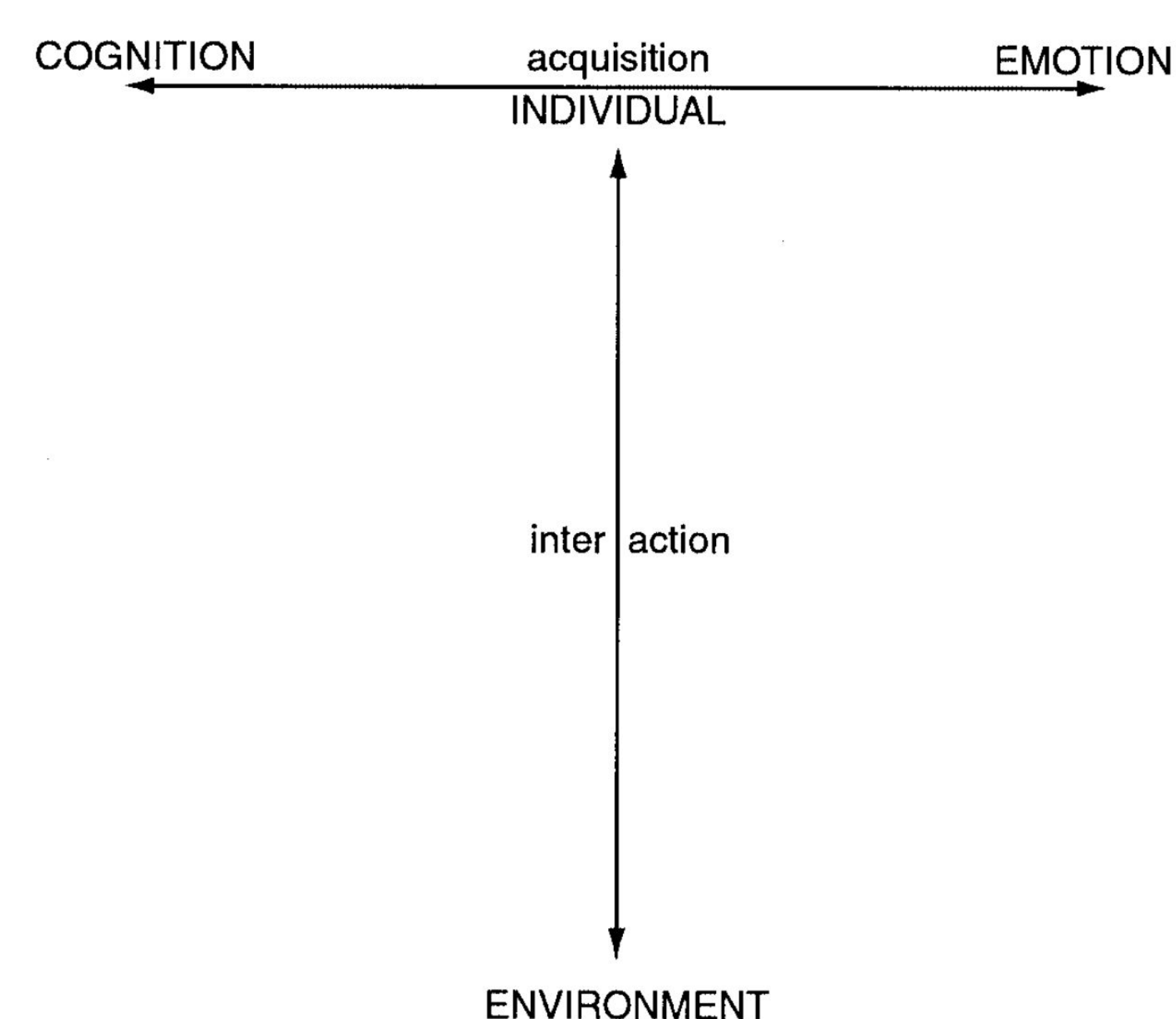
- Five years after graduation over half of the women engineers have left the engineering profession, and after 10 years only 26% still works as an engineer.
- Reasons for leaving engineering pertain to: changing interests, family responsibilities, uncomfortable work climates, and unfavorable work conditions (Fouad et al., 2017).
- Female engineers suffer from poor integration between industry experiences and the university environment, yet also “from systemic prejudices, including biases about [minority] students’ motivations, capabilities and discretionary power and detracting workplace cultures including those which are discriminatory” (Paull et al., 2019, page 4).
- Women who persist in the engineering workforce and women who leave “do not differ in three domains of self-confidence or outcome expectations, in vocational interests, or in workplace barriers. Women who continue in engineering do differ from those who leave in their experience of **workplace supports** (Fouad et al., 2016, page 79).
- By finding ways to support Latina engineers to create workplace supports, and by finding ways to create awareness in industry, we aim to contribute to retaining Latina engineers in the engineering workforce.

Significance

- Latinas are the fastest growing minority group in engineering education.
- WIL experiences are a relative safe environment to learn to negotiate engineering workplace culture: undergraduate students industry placements are relatively short, students come back to a known environment, and they are not yet fully dependent on a job in industry. This is an opportune time to support students in processing their experiences and supporting them further.

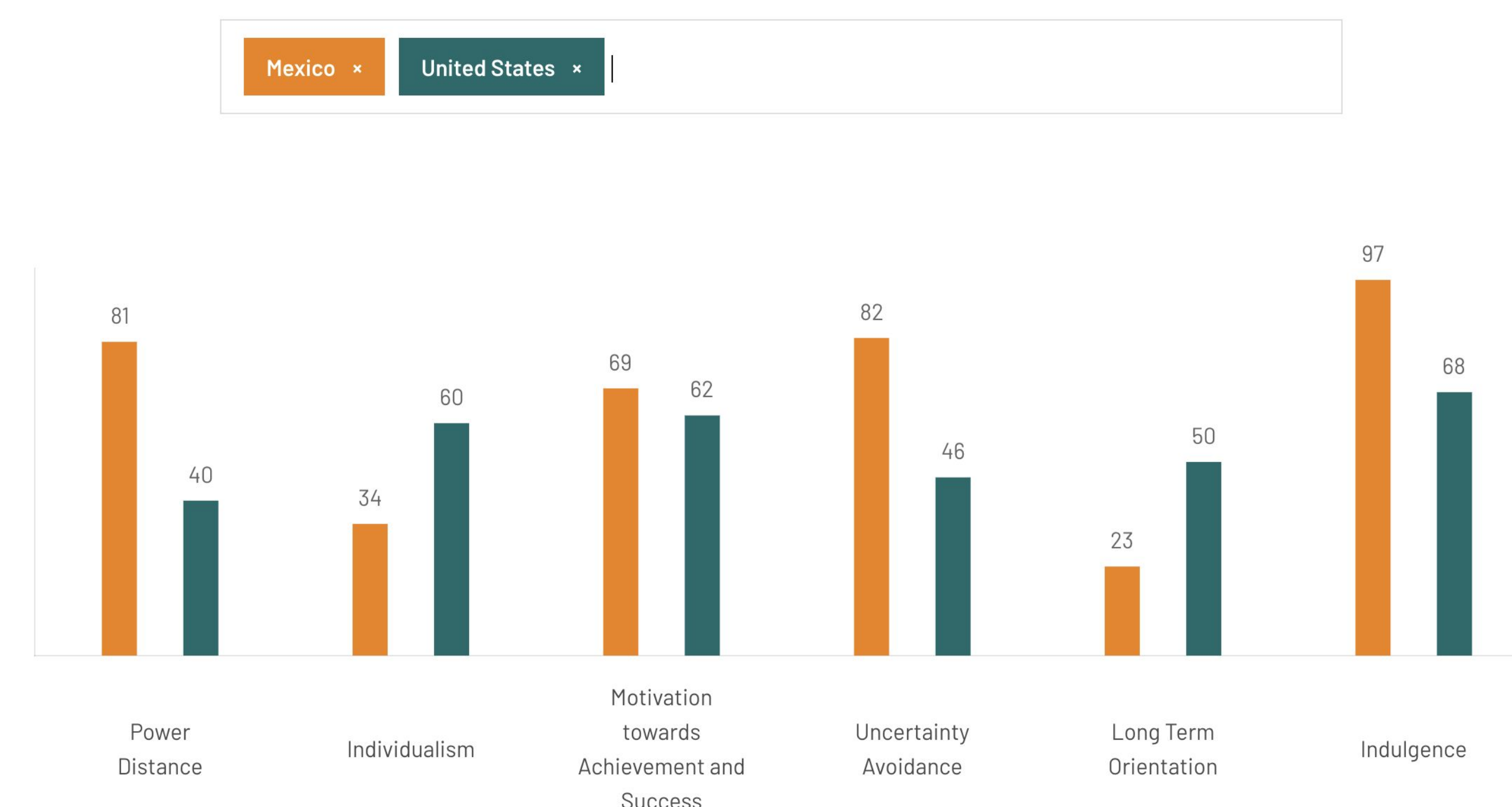
Theoretical frameworks

Illeris’ Theory of Learning



Source: Illeris (2003)

Hofstede Framework for Dimensions of Organizational Culture



Source: Minkov & Kaasa, 2022; www.Hofstede-insights.com

Methodology

Research questions

1. What are the unique experiences that Latinas face in undergraduate WIL experiences?
2. How does Latine culture influence Latina success in undergraduate WIL experiences?
3. What supports, mentoring, and/or interventions can effectively help Latinas towards successful undergraduate WIL experiences?

Research design

- A qualitative study
- Individual interviews with 20 and 30 Latina engineering students with some level of WIL experience.
- Freshmen, Sophomore, Junior and Senior students.
- We will use thematic analysis that is based on both a deductive approach (Illeris’ Model and Hofstede’s cultural dimensions) and an inductive approach that is based on the data.

Literature

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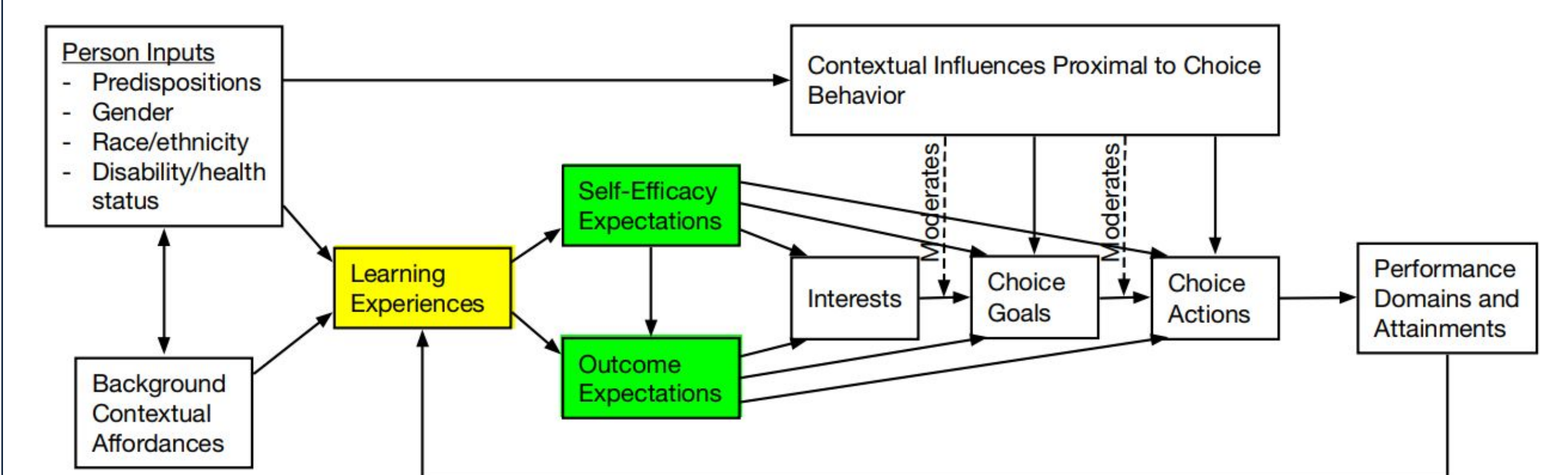
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Introduction

- A diverse and proficient STEM workforce is essential for propelling future innovations and bolstering the economy (Committee on STEM Education, 2018). A 2019 report, by the National Association of Manufacturing and consulting firm Deloitte, predicted that while the U.S. will create 3.5 million STEM jobs by 2025, approximately 2 million jobs will go unfilled due to a lack of skilled workers (Birney & McNamara, 2021; Roehrig et al., 2021).
- High school experiences play a significant role in shaping future STEM outcomes in higher education and the workforce (Rosenzweig & Chen, 2023; Wang, 2013). Despite the recognized significance of high school science internships, the current body of research is notably deficient in exploring their specific influence on directing students toward STEM fields (Rice, 2018).
- Research question: How might high school students' career choices be shaped by science internships?

Theoretical Framework

- Social Cognitive Career Theory (SCCT)** explores the interplay of psychological and social factors that influence personal interests and guide decisions in educational and career paths (Lent, Brown, and Hackett, 1994) and primarily stems from Bandura's general Social Cognitive Theory (1986).
- Self-efficacy expectations** represent people's beliefs in their capabilities to enact behaviors to succeed in different activity domains and are responsive to four major sources of information: mastery experiences, vicarious experiences, verbal persuasion, and physiological and affective states.
- Outcome expectations** focus on the perceived consequences of activity engagement in different performance domains and can be material, social or self-evaluative.



Research Methods

Research Context

- Work With A Scientist Program funded by National Science Foundation
- UTEP College of Education managed the program
- UTEP Environmental Health & Safety Office conducted safety training
- School district central office provided support and resources
- 3 local Title 1 high schools actively participated
- 7-month internships (10 Saturdays in Spring and 30 days in summer)
- 108 high school students from Title 1 schools

Data Sources and Data Analysis

- Data Sources: 88 follow-up student interviews
- Data Analysis:
 - Thematic analysis (Braun & Clarke, 2021)
 - Intercoder agreement (Campbell et al., 2013)
 - Kappa=.879 for analysis on student career choice changes
 - Kappa=.816 for analysis on their career choice change reasoning

Data Analysis Results

Table 1. Changes of High School Students' Career Choices Shaped by Science Internships

Category/Sub-Category	Definition	Example	Number (Percentage)	
No change	1.Keep original plans	Participants simply would like to stick to their original plans even after the internship.	04_1L1LV_Well, not really because what I'm focusing on is to become a psychologist.	5 (5.68%)
Enhance	2.Enhance choosing original plans	Participants would like to maintain their original plans, acknowledging that the internship experience enhances and reassures these plans in a deeper and more sophisticated way.	60_3L1AB_ I kind of already wanted to go in this [position]? It's pushed me in the same direction. Yeah. Just more that way.	31 (35.23%)
	3.Inspired to college	Participants do not mention any original career plans and are inspired by their experiences at the college where the internship takes place and are motivated to pursue further education.	36_2L2EA_ Beforehand I was like, "I don't wanna go to college, man."I wanna go to college because I'm ready for it, I know I can handle it, and I know what I wanna do.	4 (4.55%)
Expand	4.Inspired to STEM	Participants do not mention any original career plans, are inspired by their STEM experiences at the internship, and further reflect their own relationship with STEM.	01_1L1EM_ After the internship, I would say I've grown basic more understanding of science, so, actually, wanna be a science major. [It opened the door for you]. Yeah.	19 (21.59%)
	5.Add/expand STEM career choices	Besides their original career plans, participants would also open to more STEM career choices	22_1L4CRY_ I'm taking mechanical engineering, that's my big goal. But then I'm gonna have this little route where it's gonna take me into it. Either being a mechanic or hoping on the program, science program, science research and stuff there in UTEP.	17 (19.32%)
Narrow down	6.Eliminate certain STEM choices	Participants do not enjoy certain STEM practices and would like to eliminate certain STEM career choices.	06_1L2AM_ So like, you know, I didn't like being in the lab, I'm not going to think about working somewhere in a lab. So I'd think more somewhere I was comfortable.	4 (4.55%)
Replace	7.Change subject choices	Participants would like to change their original plans by replacing with a new subject	02_1L1IS_ I want to be a teacher in math, but then I took Forensics this year and I really liked that what science has to do with it.	7 (7.95%)
	8.Change college choices	Participants would like to change their original plans by replacing with a new college	59_2L4RP_ Before the internship, I wanted to go to the school like East Texas. And then I was like, "Well, like, there's so much to offer here. Like, this is a really good school." And that kind of like, pushed me more to here.	1 (1.14%)

Chart 1: Changes of Students' Career Choices Shaped by Science Internships

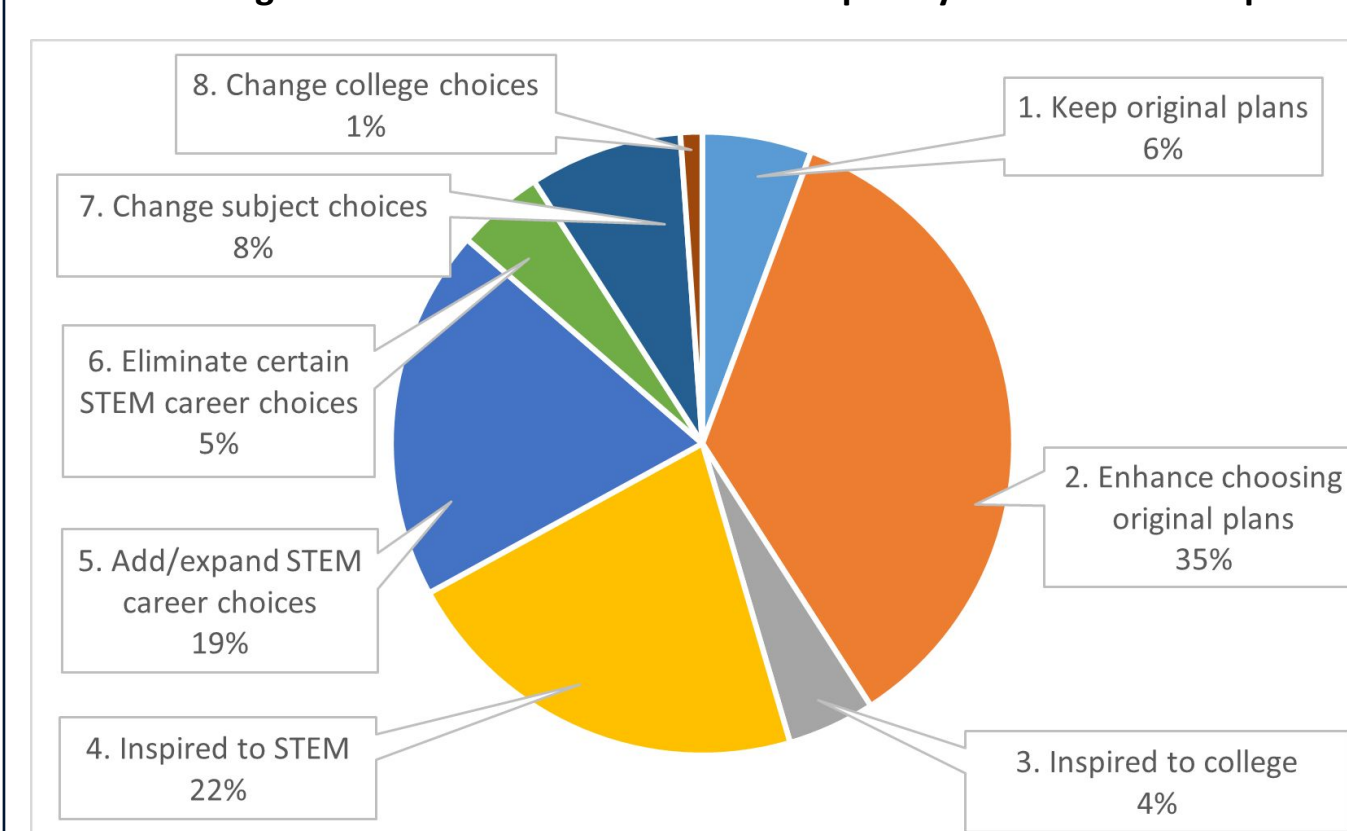


Chart 2: Reasonings of Students' Career Choice Changes from the SCCT Perspective

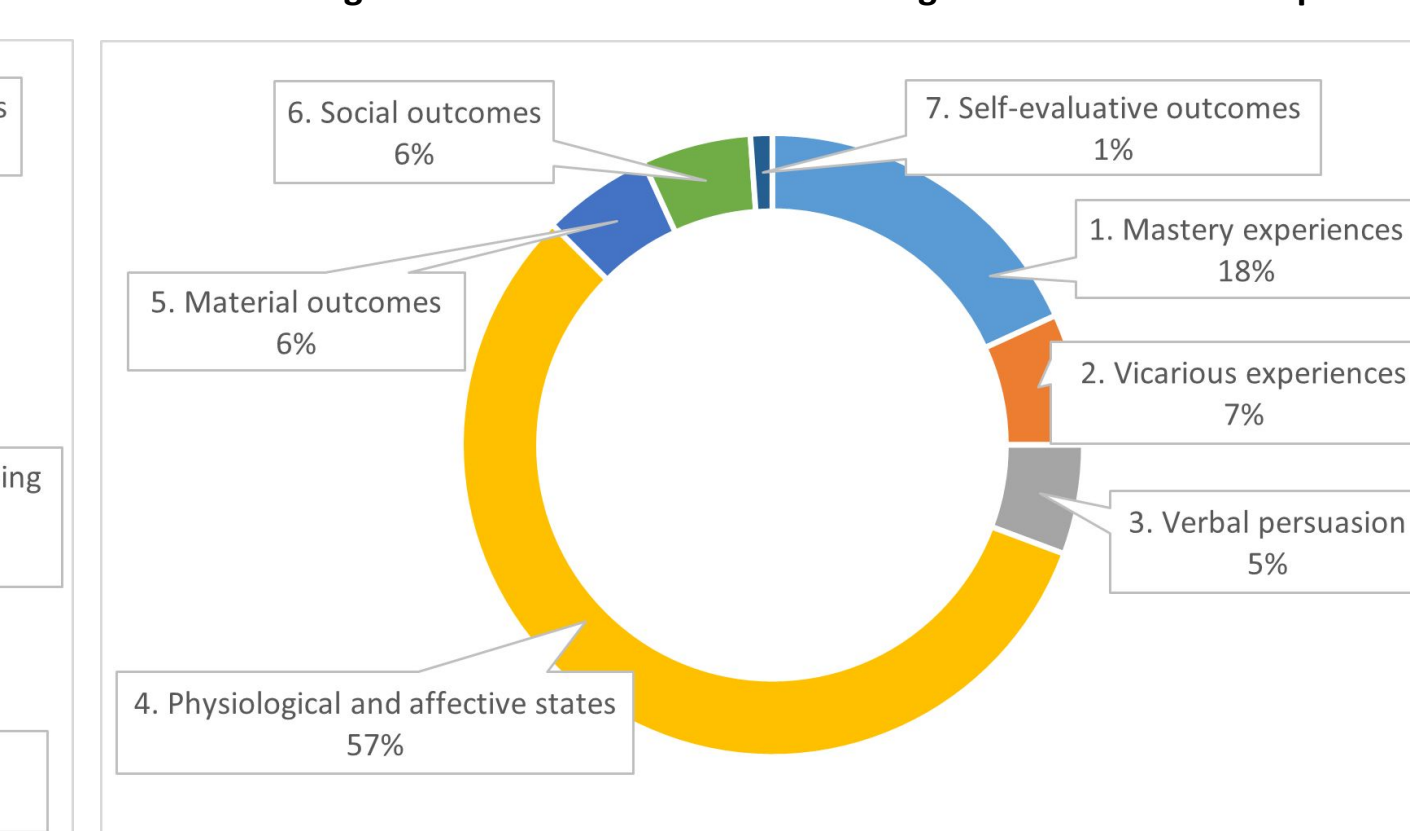


Table 2. Reasonings of Students' Career Choice Changes from the SCCT Perspective

Category/Sub-Category	Definition	Example	Number (Percentage)	
Self-efficacy Expectations	1.Mastery experiences	The internship allowed HS students to learn and conduct authentic STEM practices which help them evaluate whether they might have the capability to succeed in STEM in the future.	17_1L3LG_You know going into the lab and seeing that I can do this, you know?... [What you did it was sophomore in college science] Really? It was sophomore? I can do it.	16 (18.18%)
	2.Vicarious experiences	The internship helped HS students to observe and witness science professionals' performances and college life closely which in turn bolstered their belief that they too can master comparable activities in STEM in the future.	37_2L2ED_ Okay, now I'm gonna be more-- like I really liked what they do, so it kinda made me think like maybe that's kinda what I wanna do one day.	6 (6.82%)
	3.Verbal persuasion	The internship allowed science professionals to express their STEM working experience and faith in HS students about their capabilities in STEM which reinforced HS students' belief in their capabilities to achieve their STEM goals in the future.	41_2L2SE_ I've been talking to like the RAs and stuff, um, just listening to like their stories and stuff, I think help me like figure out like what I want-- what I really want to do like the rest of my life.	5 (5.68%)
	4.Physiological and affective states	The internship helped HS students understand their own emotional, physical, and psychological well-being towards college life and STEM practices which influence their future career choice in STEM.	83_3L3SC_ Yeah. It helped me actually pick a career that I really like and that I'll actually wanna go into instead of just, like, guessing.	50 (56.82%)
Outcome expectations	5.Material outcomes	The internship helped HS students have better understandings about the possible material outcomes (salary, awards, grade, etc.) STEM produces, which influence their future career choice in STEM.	20_1L4BQ_ After this program---you know, I decided "Yeah, please college." I mean, that's a better life for me and you have a degree, and when you apply for jobs then, I mean, that's what they want to look for.	5 (5.68%)
	6.Social outcomes	The internship helped HS students have better understandings about the social outcomes and societal contribution (social approval, social status, social benefits, etc.) STEM produces, which influence their future career choice in STEM.	48_2L3MI_ Oh, basically I want to be an inventor. I want to be a civil engineer. I want to make the world a better place, make the environment cleaner, just like create things to help people.	5 (5.68%)
	7.Self-evaluative outcomes	The internship helped HS students have better understandings about the positive self-evaluative reactions they experience (pride, self-satisfaction, self-worth, etc.) if they pursue STEM, which influence their future career choice in STEM.	30_2L1IG_ It's just a decisions that I have to make 'cause it-- uh, like since I developed that self-independence that made me like decide, like make a decision on my own where it's like I had to just be really careful.	1 (1.14%)

Major Findings

Changes of High School Students' Career Choices Shaped by Science Internships

- Five categories and eight sub-categories of career choice changes were identified.
- A majority (94.32%) of high school students affirmed that these science internships changed their career choices through either enhancing (35.23%), expanding (45.45%), narrowing down (4.55%), or replacing (9.09%) their career choices.

Reasonings of Students' Career Choice Changes from the SCCT Perspective

- Two categories and seven sub-categories of reasonings of students' career choice changes were identified.
- High school students attributed their career choice changes mostly based on the category of self-efficacy expectations (87.5%), rather than the category of outcome expectations (12.5%).
- Notably, science internships particularly helped students understand their physiological and affective states (56.82%) towards STEM fields.



Implications

- Internship Design:** This study emphasizes the importance of science internships in helping students understand their physiological and affective states towards STEM fields. Future science internships can be designed to enhance other dimensions of self-efficacy expectations to guide students to STEM fields.
- Career Counseling:** Career counselors in schools can utilize this study's findings as a resource to effectively communicate the potential benefits of science internships. These insights can help students understand how internships can shape their career paths in STEM fields and empower them to make informed decisions.
- Educational Policy:** Given the fact that the majority of students' career choices was shaped by the science internships, educators might consider integrating such internships into science education to steer more students towards STEM fields, meeting the demand for STEM professionals.
- Further Research:** The finding in this qualitative research can potentially serve as a foundation to design instruments to better understand the impacts of science internships on students' career choices quantitatively.

Acknowledgements



No. DRL 1322600





The effect of a STEM integrated curriculum on design thinking dispositions in middle school students: A mixed methods study



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Introduction

- Due to a continued lack of qualified STEM (Science, Technology Engineering and Mathematics) personnel to meet the demands of an increasingly technological workplace, K-12 schools are incorporating STEM activities and curriculum beginning in early childhood education and continuing throughout the middle and high school years.
- A STEM integrated curriculum uses the engineering design process to promote problem solving and critical thinking skills while relying on the use of disciplinary knowledge learned in math and science classes.
- The engineering design process supports design thinking and is viewed as having the potential to address social, political, economic, and technological issues (Koh et al., 2015).
- Design thinking processes use creativity and collaboration to solve problems that are human-centered, and design thinking is viewed as an essential skill in the modern workplace (Li & Zhan, 2022).
- Understanding how STEM in schools impacts students and specifically how STEM can develop design thinking is critical to understanding how resources can best be used

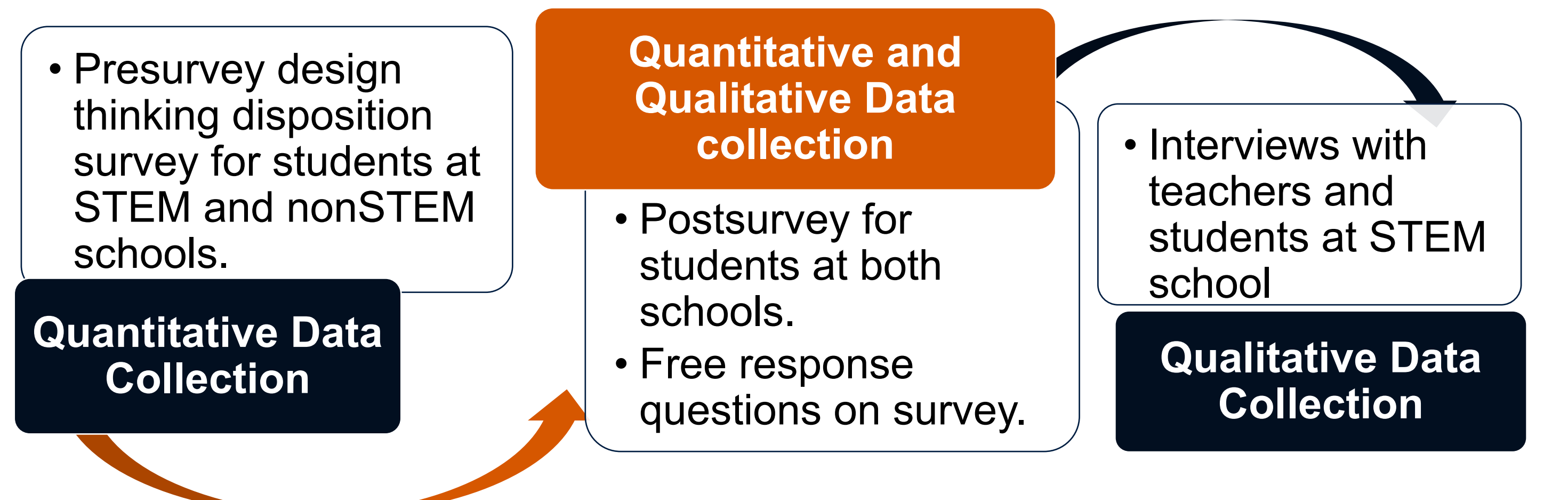
This mixed methods study addressed the following research questions:

- What is the impact of an integrated STEM curriculum in developing design thinking dispositions in middle school students?
- What are the perceptions of students and teachers on how a STEM integrated curriculum helps to develop design thinking dispositions?

Research Methods

This study followed an explanatory sequential mixed methods study design.

- Quantitative data was collected from seventh grade students using the Design Thinking Disposition survey. Seventh graders from both a STEM and nonSTEM school received a pre and post survey at the beginning and end of the semester.
- Qualitative data was collected from free response questions on the survey and from student and teacher interviews at the STEM school. Qualitative data was collected to show how design thinking differs after students have been a part of a STEM integrated curriculum program.



Participants

School	STEM	NonSTEM
Student Population	696	656
% Hispanic	94.5	94.4
% ELL	27.3	37.7
7th Graders	245	235
7th Grade Participants	26	33

The Instrument

The Design Thinking Disposition scale (Tsai & Wang, 2021) was developed specifically for middle-school and measures the following aspects of design thinking:

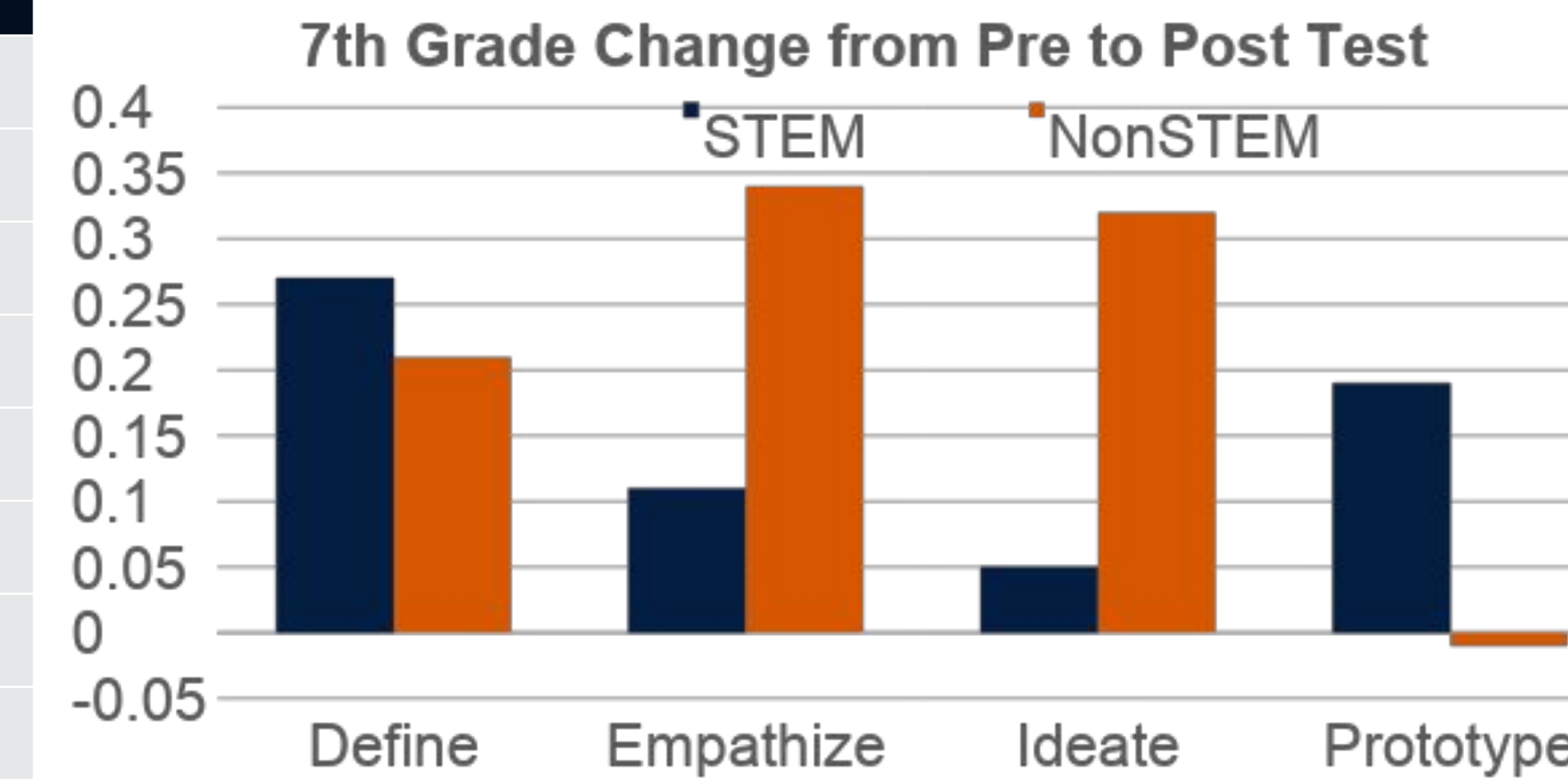
- Empathize: "I usually try to see the problem from the users' point of view."
- Define: "I usually try to better understand the problem that must be solved."
- Ideate: "I usually come up with new solutions."
- Prototype: "I usually try to make a model to test my solution to see if it works."

The survey used a five-point Likert scale rating 1-5 from "not like me at all" to "very much like me."

Results

Quantitative Results

	School	Pretest	Posttest
Define	STEM	3.55	3.82
	NonSTEM	3.46	3.67
Empathize	STEM	3.47	3.52
	NonSTEM	3.14	3.48
Ideate	STEM	3.47	3.52
	NonSTEM	3.24	3.56
Prototype	STEM	3.02	3.21
	NonSTEM	2.92	2.91



Seventh Graders showed no significant differences between the STEM and nonSTEM school in changes in each of the four areas of design thinking dispositions tested. P values for each area were as follows:

- Define: 0.58, Empathize: 0.99, Ideate: 0.64, Prototype: 0.20

Free response questions included yes or no questions on if students thought they were better at problem solving or designing solutions at the end of the year than at the beginning. Students were also surveyed on whether they were interested in pursuing a STEM career. Students from the STEM school had a statistically significant difference in their perceived ability to design solutions $p < 0.05$.

Free Response Question Results

	STEM	NonSTEM	P values
Problem Solving	65%	60%	0.678
Designing Solutions	81%	43%	0.004
STEM Career	54%	52%	0.703

Qualitative Results

- Thirteen seventh grade students and three teachers from the STEM school participated in semi-structured interviews. Questions related to what they enjoyed about their STEM class, how they went about designing solutions to problems and what careers they were interested in pursuing.
- Both teacher and student interviews were coded by two researchers until an interrater reliability of 88% was achieved. All thirteen students mentioned the codes "finding a solution," "collaboration," and "hands-on" in their interviews. Additional identified codes included "satisfaction," "job stability," "impact on others," and "choice."

Final Coding Rubric – Student Interviews

Code	Example	% of Students
Finding a Solution	"Just look at the resources you have around. And if it doesn't work just try to modify it."	100%
Choice	"And we do whatever we want – like we get to be creative in that class."	31%
Collaboration	"There's more minds, to think of better ideas to help with the project."	100%
Impact on others	"You have to think how they will use it and if it will work for that specific person."	62%
Hands-On	"I like when we get to build things and program it."	100%
Satisfaction	"We do a lot of stuff in there that I really enjoy."	92%
Job Stability	"Now my parents are struggling, so I kind of want to like help them."	92%

Major Findings

- Based on seventh grade response questions, an integrated STEM curriculum can help students develop a greater belief in their perceived design-thinking abilities. 81% of the students at the STEM school believed they had improved compared to 43% at the nonSTEM school.
- Student and teacher interviews showed how STEM curriculum benefits students through collaborative, hands-on activities and exposure to different STEM career options. Students enjoyed their STEM classes, and they considered the needs of the end user.
- Although STEM students scored higher in all dimensions on the design thinking disposition scale, the lack of significance might be due to small sample sizes or how the curriculum was implemented. Teachers may have to spend additional time on developing skills and scaffolding instruction (Sikka, 1991).

Implications

- Students that think they can succeed in school are more engaged in learning, and self-efficacy in STEM is a predictor of students pursuing a career in STEM fields (Falco, 2020). STEM students showed more confidence in their design thinking abilities which can increase student engagement and a likelihood that the student will pursue STEM subjects in the future.
- Although the differences in design thinking dispositions between the STEM school and the nonSTEM school were not statistically significant it does not mean that there are not benefits to incorporating STEM integrated curriculum into schools. Both teachers and students thought the STEM class promoted collaboration and hands-on problem solving. Students can still have positive experiences and gain both collaboration and communication skills

Recommendations

Recommendations for practice:

- The lowest scoring domain for both schools in both pre and post testing was *prototyping*. The *prototype* dimension can be developed during design activities by developing sketching skills and teaching how to prototype (Zhou et al., 2017).
- Due to the lack of codes in the *define* dimension, teachers should encourage students reframe and develop narrower problem statements generate more fruitful ideas (Shanks, 2012).

Recommendations for research:

- Use longitudinal data to track differences in future educational and career choices of STEM and nonSTEM students.
- Design an instrument that evaluates how students are generating and evaluating solutions through collaboration.
- Studying larger sample sizes might provide more significant differences among groups.

Acknowledgements

Thank you to the school district for allowing me to conduct research in their schools and to the students, teachers and administrators that were so willing to give their time to participate in this research project.

Introduction

Project-Based Learning (PBL or PBL) as a K-12 instructional model addresses a vital need for the development of 21st century skills to prepare students for success in the real-world (Bell, 2010; Condliffe et al., 2017; Sasson et al., 2018; Larmer et al., 2015). At the same time, we continue to struggle to find examples of successful school-wide implementation of PBL that allows *all* students the opportunity to benefit from this rigorous and authentic approach to instruction and learning (Kokotsaki et al., 2016). While much is known about the positive impact of PBL on student learning, the majority of empirical studies have focused on teachers with limited experience and time with PBL.

Objectives

There is significant research on the challenges associated with PBL implementation, however research on how teachers persist through challenges to sustain PBL over time in K-12 schools is missing. IS 289 Hudson River Middle School in NYC, NY, is a rare example of sustained PBL in a public middle school.

- **Address the gap** in our understanding of the experience of teachers who *sustain* PBL and persist through challenges
- **Inform practices and policies** by exploring teachers' lived experience while sustaining PBL at IS 289 Hudson River Middle School.
- **Ultimately broaden the reach** of PBL to more students across our K-12 educational system.

RQ: **How do teachers sustain PBL in a public middle school with a long-term, school-wide PBL program?**

Methodology

- This pilot study will use a **basic qualitative methodology** (Merriam & Tisdell, 2016)
- Semi-structured Zoom **interviews** as the primary data collection method (Merriam & Tisdell, 2016; Seidman, 2019).
- 2-3 participants will provide one interview each, lasting approximately 60-70 minutes, and interviews will be audio-recorded and transcribed. I plan to use open coding to identify initial codes. Focused coding will be used to further analyze and theorize the codes to generate categories and or themes.

Results

In progress: Currently 2 teachers (Math and ELAR) with 20+ years experience in PBL at IS 289 have agreed to interviews scheduled for March 2024.



IS 289 Logo [Online image]. 2024. <https://www.is289.org/>

Project

Gold Standard PBL

Seven Essential Project Design Elements



Gold Standard PBL [Online image]. (2024). PBLworks. <https://www.pblworks.org/what-is-pbl>

Significance

Unfortunately, PBL as an instructional model has been largely relegated to Gifted and Talented programs, electives, Advanced Placement courses, afterschool programs, and choice specialized secondary schools leaving many of our underserved populations without access to high quality and rigorous instructional models. Learning more about how teachers and schools sustain PBL over time may ultimately support local efforts in broadening the reach of PBL to *all* our students.

Yosso (2002) “ While these structures may offer wonderful resources to the students they serve, they also structure racial inequality starting from preschool and impacting students well beyond college” (p. 93).

Mehta and Fine (2015) argue that “High schools in particular tend to ask only the most capable students to engage in ambitious thinking; students in lower tracks and in higher-poverty schools are least challenged” (p. 1).

Beven and Penuel (2018) recognize that “Instructional practice to deliver on the set of deeper learning outcomes—like many other progressive education projects—has not been uniformly distributed throughout the system. Affluent communities have historically had greater access to deeper learning opportunities in line with professional careers, whereas students in higher poverty communities are more likely to be offered “rule-following” learning experiences that reflect factory and working-class jobs (p. 199).

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