

How Latino children in the U.S. engage in collaborative online information problem solving with their families

LAURA R. PINA, University of Washington
CARMEN GONZALEZ, University of Washington
CAROLINA NIETO, University of Washington
WENDY ROLDAN, University of Washington
EDGAR ONOFRE, University of Washington
JASON C. YIP, University of Washington

Approximately 8 million U.S. children have at least one immigrant parent. Lower-socioeconomic (SES) immigrant parents often rely on their children's language skills to problem-solve family needs—a practice known as brokering. Yet it is unknown how children use their language and digital literacy skills to search and broker information online. This paper examines *how* children with lower-SES immigrant parents search and broker information online. We focused on Latino families as they are the fastest growing U.S. minority group. We conducted in-home interviews and observations of search tasks with 23 parent-child dyads. We demonstrate: (1) how Online Search and Brokering (OSB) is impacted by familial values and resources at an individual, family, community, and digital infrastructure level, and (2) through search vignettes, *how* parent-child dyads problem-solve family needs through OSB. Our work demonstrates a different purpose of technology use in families: intergenerational, bilingual, and online co-searching to problem-solve family needs.

CCS Concepts: **Human-centered computing** → **Collaborative and social computing** → **Empirical studies in collaborative and social computing**

KEYWORDS

Collaborative search; family; Latino families, bilingual search; joint media engagement; families and children; brokering

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1 INTRODUCTION

Of the approximately 51.3 million children (ages 5 – 17) in the U.S., close to 8 million (16%) live with at least one English-language learner (ELL) parent [119,120]. ELL parents depend on their children's native English language skills and assistance to access online and offline information and resources related to critical contexts such as health concerns, financial decisions, social service needs, and employment opportunities [16,36,55–59,61,84,86].

In the digital era, ELL parents of lower-socioeconomic status (SES) with limited literacy and digital skills struggle to process online information [61,93]. Consequently, children in these families not only broker language, but also technology and online information [22,24,36]. In these families, children's household duties extend beyond traditional chore responsibilities to the role of the family's information-seeker and problem-solver [36,56,61]. We refer to these interactions as *Online Search and Brokering* (OSB), the phenomenon during which parents and children work collaboratively to address family information needs using digital resources. Our work focuses on bilingual families, which we define as families with ELL adults and bilingual youth.

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Previous work on OSB has identified how children in lower-SES bilingual families lead efforts to access online information [57,108,118]. However, this work has not examined how socio-ecological factors (e.g., family, community, and technology resources) influence the way bilingual families engage in collaborative OSB. Furthermore, previous work has not observed how OSB occurs in situ, and what challenges families might face during collaboration around OSB. Our work contextualizes OSB by examining the practice through a social-ecological framework [14,104] that considers how individual skills, family dynamics, and structural conditions shape the OSB experience.

This investigation focuses on the nature of family OSB interactions in lower-SES, bilingual Latino families. Prior work in HCI on individual online searching often focuses on higher-SES, monolingual, and majority Caucasian populations [10,11,13]. Technology adoption among Latinos, the fastest growing minority in the U.S.[17], is helping to narrow long-standing digital divides [15]. Our research explores a new avenue in CSCW within an understudied, yet rapidly growing community. Our approach contextualizes adult-youth collaboration and highlights skills and assets that are often overlooked. We uncover a nuanced form of technology engagement that fosters collaboration, learning, and problem solving. To understand how OSB practices occur in bilingual Latino families we asked the following questions:

RQ1: What are the socio-ecological factors that impact collaborative OSB practices in bilingual families?

RQ2: How does collaborative OSB occur in bilingual families?

For this study, we conducted in-home visits with adult-youth dyads from 23 Latino families in the U.S. These visits consisted of: (1) interviewing the ELL adult family member and the youth (ages 10 – 17) separately, and (2) observing adult-youth dyads completing online search tasks together. The first half of our results examine factors that influence OSB processes from a social-ecological perspective. This approach lays the foundation towards understanding what OSB looks like during context-specific scenarios. The second half provides three representative vignettes of *how* the process OSB occurs and contextualizes OSB as problem-solving task.

Our research makes three contributions to the CSCW community. The first is a new empirical understanding of how situational contexts shape the way in which Latino ELL parents and their children perceive and engage in OSB practices. Such an understanding can inform the design of culturally-tailored tools and resources for this population. Second, we contribute new insights on digital information seeking practices as means to address critical family information needs. Third, we develop a foundation that can encourage information interventions to acknowledge and leverage collaboration between parents and children. From a social perspective, studying online search within this particular community is important as it allows us to understand the impact on social mobility when children lead the charge in connecting their family to resources.

2 RELATED WORK

2.1 Brokering in Immigrant and Bilingual Families

Through interviews and surveys with both parents and children, scholars have documented how children help their parents adopt new digital devices and troubleshoot their use. Parents, in both lower- and higher-SES families, often learn how to use technology from their children [22,23,26,36,81]. This knowledge transmission from child-to-parent, also known as *technology brokering*, challenges traditional conceptions of top-down technology mediation and digital literacy transmission.

However, there are notable differences on how *technology brokering* manifests in families from different backgrounds. Children in higher-SES families may teach their parents how to use media, smartphones, tablets, and apps, but they do not often help their parents with aspects of technology that can impact access to information, such as email or web searches [81]. In contrast, parents in lower-SES families are more likely to have less experience with technology and limited digital literacy skills and, therefore, rely on their children to broker technology in a way that impacts their own productivity [16,22,26].

Research on offline and non-digital youth *language brokering* has shown that ELL language brokering often occurs spontaneously and is “interwoven into the fabric of everyday life” [86]. Parents and their children often work together in teams to address family needs. In these collaborative moments, different kinds of expertise are leveraged, competence is distributed, and learning becomes reciprocal and intergenerational [2,33,92,109]. While prior research shows how children engage in reflective thinking as they derive meaning from multiple languages [109], there is limited understanding of the cognitive processes involved in language brokering, and much less when technology is involved.

Furthermore, immigrant parents in particular, who are often navigating new social environments, rely on their children to help them make sense of information related to health, finances, or other family needs—much of this information can now be accessed online but might be difficult to find and interpret [16,36,61]. A recent national survey of lower-income parents in the U.S. revealed that Latino immigrant parents with lower-SES status, limited English-language proficiency, and without a high school degree rely more on their children to broker technology and online information compared to parents of other backgrounds [61,108]. Thus, children in such families take on greater responsibilities that often follow them throughout adulthood [16,22,26].

2.2 Families and Technology

Work in HCI and CSCW has explored how families use technologies to communicate and stay connected [115], to create and collaborate [95], and to coordinate [27]. Recent research has examined parents’ and children’s perspectives on the rules of technology use in the family [51,72], parents’ reflections on their own use of technology, what they are willing to disclose online about their children [5,12,42,65,78], parents’ key role in their child’s technology learning [8], parents’ development of different roles as learning partners to support their children [8,95], and parents’ reactions to how children use technology [18,67,70].

Joint Media Engagement (JME) is a particularly useful framework to examine the experiences of people using media together, which include viewing, playing, searching, reading, contributing, and creating with either digital or traditional media [101,105]. In families, JME is viewed as the process of learning between parents and children through the co-creation of meaningful connections among interests, experiences, and representations. As technology has become ubiquitous, JME has expanded to consider “all forms of media, especially those that dominate young people’s time and experience” and not just the educational ones [105]. For HCI researchers, JME has been used to study intergenerational play of digital games [43,101], digital storytelling [90,91], and interactive videos [7]. This body of work emphasizes family fun, relationship development, and learning.

However, it should be noted that a majority of research on children, family, and technology has focused primarily on middle- or higher-SES families and non-immigrant families [1,8,21,51,72,111]. By predominantly studying families from higher-SES backgrounds, our understanding of the role of technology within families is limited [105]. Digital inequality (i.e., unequal access to information and communication technology) exists between families of different socioeconomic backgrounds [61]. There is a growing body of work examining the challenges lower-SES families experience when navigating digital tools and resources. Levinson found that lower-SES Latino families use language and literacy-related tablet applications to learn English together [68]. On the other hand, Ames et al. found that there are unintentional biases in technologies that impact how children of lower-SES and underrepresented ethnicities gain computational skills that go beyond overcoming computer and internet access [4]. Furthermore, DiSalvo et al. found that despite the access to online learning tools, lower-SES African American families struggle to access computer science online learning tools [30]. Without acknowledgment of the differences between higher- and lower-SES groups, we risk marginalizing and ignoring the effects of socioeconomic status on technology usage [114].

Our contribution to the body of work on families and technology is threefold: (1) we examine the resources at a family, community, and societal level that impact how bilingual Latino families search for information online; (2) we illustrate, through vignettes, how collaborative OSB takes place; and (3) we demonstrate a different use of technology—to find, interpret, and apply information that impacts a family unit’s wellbeing.

2.3 Individual and Collaborative Search Practices

Prior research in library and information science has examined how individuals search online and make sense of digital information [37,50,62,63,99,113]. For instance, the *Information Problem-Solving for the Internet*

(IPS-I) model examines what processes and skill sets are necessary for individuals to search efficiently online [13]. More recently, research in HCI has identified types of searchers (e.g., visual, social) in adults [64], adolescents [38], and children [32,38].

Other work has shown how online search is not necessarily a solitary practice, but rather can be a collaborative and distributed process between peer searchers [49,77]. Collaborative search, in this context, focuses on skilled peers using online tools to remotely collaborate to search for information online. Collaborative search has focused on how adults work together to solve a need for information [40,77,98]. These studies either created their own online tools or studied collaborative searches that occur through online social networks and Q&A sites [77,79,80,82,96]. Collaborative search enhances search quality because it improves recall of information [87,98], reinforces search skills through exposure and learning from others' strategies [20,38], and strengthens social connections [79,80].

In our literature review, we did not find work detailing intergenerational collaborative search practices between adults and youth. Previous work has found that youth search skills influence how adult family members develop their own search habits [34,47]. For adolescents, their search skills influence their parents' family decisions, particularly when it comes to purchases [10]. Research on bilingual and immigrant families has found that youth use search for information online and help adults interpret information that impacts the stability and wellbeing of families [57,108]. Despite research identifying that the phenomenon of intergenerational search exists, there is a need for a holistic investigation of *how* in-person collaborative search takes place as an intergenerational, bilingual practice.

3 METHODOLOGY AND ANALYSIS

Our qualitative study consisted of multiple home-visits per family. We conducted the study between July 2016 and June 2017. This study took place in a major metropolitan city in the U.S. in the Pacific Northwest within a 32-kilometer radius of our research institution.

3.1 Participants

We conducted this study with 23 families (25 parents and grandparents; 23 children ages 10 – 17; 2 adult children) that fit the following criteria: (1) the family has at least one adult member self-identified as Hispanic or Latino and was born in Latin America, (2) the family has a child between the ages of 10 to 17, and (3) the adult member reports that their child helps search for and translate online content. We chose the age range of 10 – 17 because that is the age in which youth are likely to broker for their families [61,86]. The demographics of the participants are found in Table 1, which include family roles, ages, education levels, and adults' occupation and country of birth. Among youth, 63% identified as female with a median age of 13. For adults, 79% identified as female with a median age of 41. Most of the participating adults were born in Mexico, were not college-educated, and worked in services industries. In an attempt to be culturally sensitive amidst a tense political climate (where Latino families felt vulnerable), we did not explicitly ask about household incomes. That said, we are confident that our participants represent a lower-SES population. The education level, place of birth, and occupation of our participants correlate with lower household incomes [13,66,73]. Immigrant and ethnic communities in the U.S. often struggle to trust researchers and institutions, therefore, we recruited participants through multiple strategies, including community center networks, local heritage events, and a paid community liaison with strong ties to Latino families.

3.2 Study Design

Our study consisted of two separate visits per participating family. All meetings occurred in the family home. We decided to do home visits because they allow participants to feel comfortable, to be in the environment in which they actually engage in searching and brokering, to use their own technology and infrastructure, and to access additional materials they might use to search for information [45,94]. Furthermore, home visits allow researchers to observe search practices within the family's home digital infrastructure, which includes quality of internet bandwidth and mobile phone reception [44,60].

We compensated each family member who participated in any of our visits. Adults received \$25 and youth received \$15 per visit. We focused on adult-youth dyads because of our interest in family-based intergenerational and bilingual information search. As Table 1 shows, this dyad generally consisted of a parent-child pairing, but we allowed other individuals who were identified as collaborators to participate. Many of our visits occurred in multigenerational households. We had three grandparents-grandchild dyads in our study.

In these families, grandparents reported working with their grandchildren to broker information. Other families (e.g., F6 and F12) worked closely with extended family members and family friends when it came to OSB. To capture and examine OSB practices as naturally as possible, we invited these members of the collaboration to participate in the study.

ID	Relationship	Occupation	Parental birthplace	Grade completed	ID	Relationship	Occupation	Parental birthplace	Grade completed
F1	Mother (41) Daughter (13)	Housekeeping	Mexico	Secondary 8 th grade	F13	Mother (40) Son (13)	Housekeeping	Mexico	Secondary 8 th grade
F2	Mother (39) Daughter (10)	Hospitality	Mexico	Primary 4 th grade	F14	Grandmother (63) Grandson (10)	Unemployed	Peru	Bachelors 5 th grade
F3	Mother (45) Daughter (16)	Housekeeping	Mexico	Secondary 11 th grade	F15	Mother (48) Son (11); Daughter (19) ^{v2}	Homemaker	Mexico	Primary 6 th grade 12 th grade
F4	Mother (39) Daughter (17)	Student	Peru	Secondary 12 th grade	F16	Grandfather (56) Grandson (8)	Food Industry	Honduras	Secondary 2 nd grade
F5	Mother (51) Father (50) Daughter (16)	Homemaker Dry Cleaning	Mexico	Primary 11 th grade	F17	Grandfather (62) Grandson (12)	Food Industry	Mexico	Secondary 7 th grade
F6	Mother (36) Son (13) Niece (18) ^{v2}	Hospitality	Mexico	Secondary 8 th grade	F18	Mother (41) Daughter (16)	Social Worker	Mexico	Bachelors 10 th grade
F7	Mother (41) Daughter (11)	Homemaker	Mexico	Secondary 6 th grade	F19	Mother (52) Son (11)	Unemployed	Mexico	Secondary 5 th grade
F8	Mother (41) Daughter (10)	Food Industry	Mexico	Secondary 5 th grade	F20	Mother (38) Son (11) Son (17) ^{v2}	Homemaker	Mexico	Secondary 5 th grade 12 th grade
F9	Father (46) Daughter (10)	Gardener	Mexico	Primary 5 th grade	F21	Mother (42) Daughter (15)	Housekeeping	Mexico	Secondary 10 th grade
F10	Father (36) Mother (32) Daughter (14)	Cook Homemaker	Mexico	Secondary 8 th grade	F22	Mother (40) Daughter (16)	Housekeeping	Mexico	Secondary 10 th grade
F11	Father (40) Daughter (15)	Food Industry	Mexico	Secondary 9 th grade	F23	Mother (33) Daughter (13)	Unemployed	Mexico	Secondary 7 th grade
F12	Mother (55)* Son (13)	Unemployed	Mexico	Bachelors 9 th grade					

Table 1. Demographics of the families. In education level, primary refers to 1st through 6th grade and secondary refers to 7th through 12th grade. *For F12, we also interviewed the daughter in F05 because she had done OSB with the mother. Participant ^{v2} indicates only Visit 2 participation.

Visit 1 - Initial interview (V1). We chose to conduct retrospective interviews in the families' home to better contextualize where and how they search, and to gain perspective of all the different home, community, and technological infrastructure factors that influence OSB. The first visit consisted of a consent process and an interview about the families' digital ecologies and search habits. We conducted a total of 46 separate interviews: 23 one-on-one interviews with the adult(s) (in Spanish, F5 and F10 had two parents together), and 23 one-on-one interviews with the youth (in English). The protocol for this interview was adapted from previous work on in-home media studies [60] and in-home online search interviews [38,39]. First, we mapped the location of digital technologies in the home to understand the technology infrastructure of the families. Next, we used a semi-structured interview protocol [69] to allow us to focus on our research questions, but with flexibility to identify emergent themes. Interviews lasted between 45 to 60 minutes and were audio recorded. We scheduled a second visit with participating families if we identified that adult family members and children help each other search for information online at least once a week. We transcribed all interviews (adults and youths). Parent interviews were all in Spanish and were transcribed by members of the research team fluent in Spanish and we translated in English only the most pertinent dialogue based on data analysis.

Visit 2 – Online search and brokering tasks (V2). The second in-home visit focused on directed Internet search tasks between adult-youth dyads (F5, F6, F10, and F20 included three participants). We conducted 20 search task interviews in V2. We audio recorded the search tasks, as well as video recorded the screen

interactions. This visit consisted of a set of imposed search tasks prompted by researchers, historical tasks to reflect on prior online searches, and a self-generated search task prompted by the participants. We chose to conduct these OSB tasks because we wanted to triangulate the data from V1 and understand how the contexts and perspectives of online searching manifest in the interactive dyads at home.

Observing the families doing the search tasks allowed us to probe into current practices and past search activities. We allowed the participants to use any personal technologies they were familiar with and take the searches on any path whenever they remembered or wanted to show us anything we had not covered in the directed search tasks [31,38,39,64]. V2 lasted between 30 to 60 minutes. We facilitated the tasks in a combination of Spanish and English and transcribed/translated the most relevant interactions.

Imposed tasks provided restrictions and gave youth the opportunity to search for information they otherwise would not have searched for [11,38,39]. Imposed prompts focused on a baseline search for families (finding their school's phone number) to identify search skills, and a more collaborative search (finding a family activity) informed by parents' and children's V1 reflections on brokering practices. Historical tasks prompted the adult-youth dyad to recall and recreate a task they performed in the past. The first historical prompt was open-ended, and the second focused on searching for health-related topics. We focused on health for two main reasons: 1) health is one of the major topics that emerged during V1 interviews, and 2) in the U.S., 72% of adult Internet users report they search online for health-related information [41], and U.S. teenagers (ages 13-18) consider the Internet as their primary source for health information [121]. Furthermore, a third (27%) of U.S. teens have searched for information about health conditions affecting a family member or a friend [121]. A final self-generated task allowed us to understand what youth and adults would search for if they could address a current problem together [11]. The adult-youth dyads were encouraged to address the following prompts collaboratively, to the extent they would naturally:

1. Let's pretend that your parent needs to call your school. Can you [youth] show us how you would find your school's phone number and share it with your parent? (imposed task)
2. Can you show us how you would find something fun for your family to do on the weekend? (imposed task)
3. Can you show us how you [youth] have found information for something your [parent] has asked you to search before? (historical task)
4. Can you show us how you [youth] have found information for something related to health that your [parent] has asked you to search before? (historical task) *For dyads that had never done this type of search before, we prompted: If your parent or a family member wasn't feeling well for a few days and wanted to know why, what information would you look up for them?* (imposed task)
5. Can you show us how you would find information for a problem you [adult] have today? (self-generated task)

3.4 Theoretical Framework

For our data analysis, we relied on two theoretical frameworks to interpret our data: *Ecological Systems Theory (EST)* and *Information Problem-Solving – Internet (IPS-I)*.

Ecological Systems Theory. As we identified the multiple levels of resources parents and children leveraged, we noticed that they reflected the environmental layers defined in EST [14]. This insight reflects Takeuchi and Levine's discussion on how children and families' interactions with digital media both shape and are being shaped by these interconnected ecological settings [104]. According to EST, people develop skills and learn within a system of interconnected and nested environments (Figure 1a.). The microsystem is the immediate environment in which parents and children reside (e.g., family), and this microsystem layer contains the technologies that adults and youth interact with. The mesosystem is the system that bridges home and community environments. A neighborhood, for example, contains several interconnected settings that a child inhabits, such as the school, family, and library. The exosystem is the larger social system with which the family may not directly engage but still feel its effects. For example, technological infrastructure or community resources can directly affect individual wellbeing.

Finally, the macrosystem is the most outer system and consists of the cultural contexts that shape individual and family outcomes. For example, many children who broker demonstrate a strong sense of obligation towards their family members, albeit one that can manifest in both beneficial (e.g., parent-child bonding, better academic performance) and detrimental (e.g., unhealthy role reversals, stressful interactions) ways [9,85,107,112]. To account for how the macrosystem may influence this sense of obligation, we focus on one particular cultural dimension that can be a useful contextual lens through which to investigate collaborative intergenerational searching. *Familism* is a familial orientation where the family unit takes

precedence over an individual’s needs, and one that has been shown to be salient among Latino families in particular [97]. In this orientation, children and adults have a strong tendency to support both their immediate and extended family members, not just in times of need but consistently [102]. While *familism* is not inherent in all Latino families, we posit that it is one macro-level dimension that provides cultural nuance and highlights family assets. In the results, we demonstrate how familism may impact OSB across the ecological system.

Our analysis is guided by an ecological systems perspective to make sense of the contexts and practice of OSB in ELL Latino families. By revealing the articulations between the interconnected and nested layers, we are able to reveal that OSB is not simply about a lack of linguistic skills, technology infrastructure, or digital literacy skills alone. Instead, we show that OSB is the result of bilingual families with immigrant parents attempting to coordinate information practices within many different constraints among the ecological layers. Figure 1b. shows the factors we focus on in Section 4.1.

Information Problem-Solving – Internet (IPS-I). Since families engage in OSB to solve information problems, we needed a framework to help us distill the process of OSB. We use the IPS-I model to examine how people solve information problems through online search [13]. The IPS-I operationalizes online search as five constituent skills that are linked: (1) Define information problem; (2) Search information; (3) Scan information; (4) Process information; and (5) Organize and present information. During the execution of all five skills, regulation processes happen, which orient, monitor, steer, and evaluate information seeking. The five constituent skills are dependent on a foundation of three conditional skills: (a) Reading skills; (b) Evaluating skills; and (c) Computer skills [13]. The IPS-I framework was developed to describe the process and skills *individuals* use to search for information online to address an information problem. This model helps us examine how an adult-youth dyad collaborate to address an information problem based on family needs. We use the IPS-I model in Section 4.1 and Section 4.2 to identify break downs in the process of OSB.

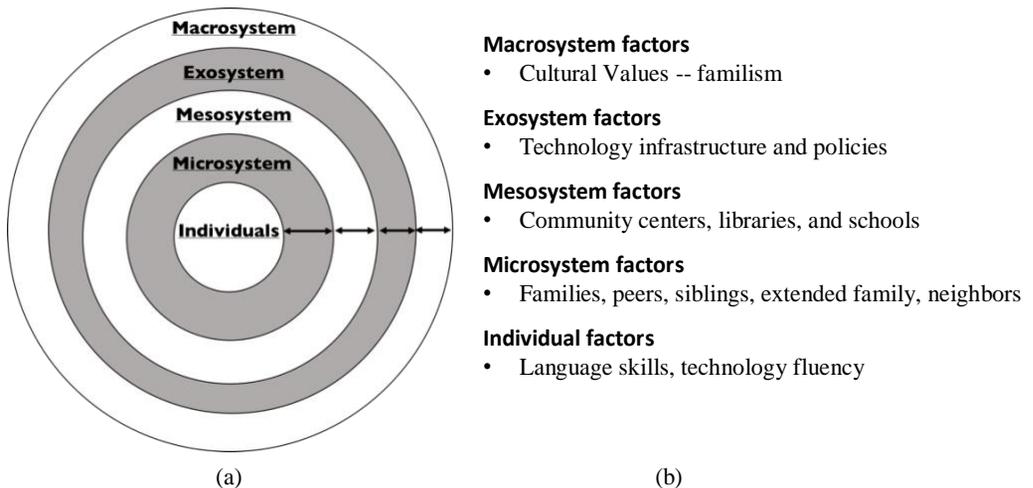


Figure 1. (a) Ecological Systems Theory (b) Ecological factors we describe in the findings

3.4 Analysis

To examine families’ contexts and perspectives around OSB (RQ1), we analyzed data from Visit 1 (V1) and Visit 2 (V2) on parents’ and children’s perceptions of OSB. Specifically, V1 provided background, context, and family members’ perspective on their practices and struggles in online search and brokering. Because V1 consisted of individual interviews, this allowed us to gather personal perspectives on how family members help each other, where they struggled, where they succeeded, and where they needed help. During the OSB tasks in V2, parents and children would also discuss their perspectives and prior personal experiences in online searching together.

To analyze the data for RQ1, we used open coding with constant comparative analysis [73] to analyze the semi-structured interviews in V1. We also used V2 data that helped inform how different ecological factors interact, such as reflections during OSB, technical support and difficulties, and what resources parent-child

dyads accessed during OSB tasks. As codes began to surface, researchers began to merge and identify common codes across researchers, such as motivations for OSB, the struggles families faced, and the strategies the families utilized. Each author acted as a primary and secondary coder. The primary coder was the first to review and code the transcripts. The secondary coder verified the codes and identified additional data points to code as appropriate. Afterwards, our team examined the codes and initial themes together, and had several groups meetings where authors discussed and did a comparative analysis of each of their codes to note similarities and differences. This iterative open coding was conducted for both parent and child interviews. We used the EST framework and IPS-I model to make sense of the larger general themes around individual abilities, family resources, community resources, and technology infrastructure.

We also wanted to learn and observe how OSB might take place in the home (RQ2). To identify and select the vignettes, we started with analytic memos of video recordings and detailed field notes. To create the memos, two authors were paired—one fluent in Spanish to translate and the other to support annotation. The pairs watched the videos and collaboratively developed analytic memos. We then open coded the data based on how families engaged in information problem-solving tasks and technology usage. These codes included: 1) task definition and query formation; 2) what technologies were used in the search; 3) scanning for information; 4) moments of collaboration, including turn taking, problem-solving, outside references, and negotiations; 5) conflicts in the search; 6) translation occurrences; and 7) how the search results were evaluated and synthesized. As we applied the coding scheme, we also made changes to the codebook when a new theme was identified. In a collaborative axial coding session [6,46], the researchers then compared and contrasted codes to analyze emerging themes with respect to the IPS-I model. Finally, we selected three OSB vignettes that demonstrated aspects of search processes: defining the problem (Vignette 1), scanning the information (Vignette 2), organizing and presenting information (Vignette 3).

4 RESULTS

To unpack the dimensions and nuances of OSB among bilingual Latino families, we provide two sections of findings. In Section 4.1, we provide the socio-ecological context in which lower SES Latino bilingual families take part in OSB. By understanding this context, we are able to instantiate the environment of where OSB takes place. In the case of studying Latino families, it allows us to understand the impact of their socio-ecological environment on their OSB practices. In Section 4.2, we provide three focal vignettes illustrating how the collaboration in OSB takes place. All names in 4.1 and 4.2 are pseudonyms. In our discussion section, we claim that family perspectives and practices around OSB provide a different perspective on JME, collaborative online search, and technological design for diverse populations.

4.1 Socio-ecological factors that impact OSB in lower-SES bilingual families

We found that families rely on *resources* that cross multiple layers of the social-ecological system. We begin with an overview of the individual abilities and skill sets the parents and children reported, and then examine how resources in each of the different ecological layers can shape how OSB is experienced. We also discuss the multi-level challenges that families face as they navigate internal and external barriers to information access.

4.1.1 Individual Abilities and Skills. Online information problem-solving depends on reading, evaluation, and computer literacy skills [13]. This means that during collaborative OSB situations, the ability to problem-solve information depends on the individual skills of both parents and children, including language ability. Of the 25 adults that participated in the study, 88% of parents ($n = 22$) did not have a college degree. Of the 22 without a college degree, 64% ($n = 16$) had completed some form of secondary school (from 9 - 12th grade), and 27% ($n = 6$) had only completed primary school (K - 8). Furthermore, all parents in this study stated they were English-language learners and that they depend on their children to translate between English and Spanish on a daily basis. 23 of the 25 adults that participated in the study reported their confidence levels in interacting with technology. 56% of parents ($n = 13$) considered themselves beginners, 35% ($n = 8$) intermediate, and 9% ($n = 2$) experts. These individual-level skills, backgrounds, and experiences impact technological self-efficacy and digital literacy, making it difficult for parents to search for information on their own [48,52].

The participating youths were of the ages between 10 and 17, which is representative of how children of immigrants often begin to broker at a young age [59]. The range of ages meant that participating children exhibited a spectrum of cognitive, literacy, language, and digital skills. With respect to their confidence in interacting with technology, 22 of the 23 participating youth reported their confidence to be: 86% ($n = 19$)

considered themselves to be intermediate, and 14% considered themselves to be advanced ($n = 3$). Similar to adults, the wide range of children's skills also impacts their ability to address their parents' information needs.

4.1.2 Family (Microsystem). The variety of skills parents and children contribute to OSB fosters an environment where family members depend on each other. During our separate interviews, parents were conflicted about disclosing sensitive information to their children, but also felt they had limited options:

Teresa (F3 mother, age 45, translation from Spanish): I have been told that psychologists are now saying having children involved in so many adult decisions is not good for them ... Who are we going to rely on when we need help? Especially, when it is about information that is private and personal.

We also found that the adult-youth dyads relied on other family members and friends to help complete OSB tasks. In family F6, Daniel (son, age 13) explained that he helped his mom, Marisol (F6 mother, age 36), for everyday low-priority searches (e.g., weather, map directions). For more complex queries, they would ask Daniel's cousin, Angelica (age 18) for help. As the eldest grandchild, Angelica's adult family members relied on her for OSB since the age of 11. For example, Marisol needed help finding a scholarship form for Daniel. While co-viewing on a laptop with Marisol, Angelica asked Marisol questions about what terms to use to find the form online. Angelica read and translated the questions on the form out loud, entered Marisol's responses, and then uploaded the form. Angelica expressed that it was her duty to help her extended family because they had no one else to turn to. The OSB work that Angelica does for her family exemplifies how OSB is a manifestation of familism in Latino families.

Balancing Individual and Family Needs. Despite children's intrinsic familial orientation, they reflected on the tensions that emerge when trying to balance parents' frequent information requests to find online information while also attending to their school responsibilities:

Denise (F10 daughter, age 14): I get frustrated because... I have my things to do, and I'm trying to hurry up...I'm helping them and ... trying to do it [search and find information online] like fast, but... I've got to do this fast because I have my homework that I have to finish and stuff.

Children had difficulty switching between non-searching activities (e.g., homework, entertainment) and online searching for family problem-solving. Parents viewed children's OSB duties as equally important as schooling. This equal priority does not often manifest itself in non-collectivist families where parents do not rely on their children to access crucial information online.

Negotiating Internal Family Trust. Parallel to tensions, varied levels of trust also emerge through OSB across families. For example, in family F12, Paula (mother, age 55) relied on the daughters of a family friend more than on her own son for more complex tasks. The son was not always motivated, and the parent and child often fought during OSB. The mother was researching treatment for her younger son, who is autistic but had concerns about her son's ability to help:

Paula (translation from Spanish): No, no. I don't even trust him [older son] to help me find information about autism for his younger brother.

It is difficult to determine the source of Paula's mistrust because it could be attributed to privacy concerns regarding how much to share with her son, or general tension between a reluctant son and a frustrated mother. While we did not explicitly ask about trust negotiations, it is a dynamic that emerged during V1 interviews and V2 search activities. At times, mistrust seemed to stem from parents doubting their children's Spanish-language skills and translation abilities. Adults felt more comfortable directly reading the information youth find in Spanish. However, children did not feel as confident searching for information in Spanish. For instance, Maggie (F23 daughter, age 13) indicated that it was embarrassing to search together with her parents because they constantly corrected her Spanish. Youth tended to first, search for answers to the problem in English, read up on the topic, then try to search again in Spanish based on what they understood from the English search. During the Spanish search they would try to identify a source that explained the problem in a similar way as how they read it in English. The level of bilingual skills needed to navigate to find information in English requires understanding information in English then finding the same information in Spanish. This additional

language brokering skill impacts the ability to define the search terms, search, scan, and identify the information and is not accounted for in the IPS-I framework.

Understanding Information Needs. Amidst internal trust negotiations, parents needed their children to provide answers to important questions about banking, health, and politics. Children in this study wanted to help their parents, but parents struggled to describe their problem (especially in English). The vague description of the problem created challenges that made it difficult for children to define the problem, identify the search terms, and then find the information parents desired:

Ana (F5 daughter, age 15): Like, my dad's shoulder pain...he's giving me descriptions...there's many things that it could go with...It might be pain... a nerve... there's a lot of remedies that can help with it, but I can never tell him, it's this specific one.

We posit that parents gave vague descriptions because they struggled with the vocabulary related to the problem. Second, identifying the correct search terms requires high digital literacy skills, especially since search interfaces do not provide guidance for how to search and what terms to use based on a particular search topic (e.g., health diagnosis). Consequently, children broker and interpret the description parents provide, which in turn, means that children present information that, from the parents' perspective, does not always relate to the problem they had asked about.

At the time of this study, the political climate in the U.S. was particularly difficult for some Latino families. Families in our study expressed anxiousness in trusting authorities and institutions with personal information. As such, parents disclosed details about the family's wellbeing, such as finances, jobs, and health information, only to their children. In doing so we found parents and children combining online and offline resources to problem-solve the problem—a process not explicitly covered in IPS-I. For example, Ariana (F19 mother, age 52) recalled that after her daughter, Susy (age 17) “figured out she was having kidney pains”, her daughter called pharmacies to consult with a pharmacist on what type of medication her mother could take over the counter. Ariana felt this was a way to get medication without having to provide too much information to a doctor she did not trust. The lack of trust in institutions and the trust parents have on their children's abilities has concerning social and public health implications.

4.1.3 Community and Institutional Resources (Mesosystem). The *mesosystem* comprises the resources from one setting that shape interactions in another. This level in the ecosystem included libraries for Internet access, non-profit organizations for skills training, and schools for children to learn about technology. These different community resources outside the home affect OSB processes. For instance, children felt grateful towards their teachers and librarians for helping them learn how to search. Denise (F10 daughter, age 14) reflected on how her teacher taught her digital literacy skills:

Denise (translation from Spanish): We had a teacher...he would teach me how to do technology...He'd teach me how to search and download things...he'd teach me the basic stuff, computers.

Denise received materials from this teacher, which she later used to search information for her parents, with step by step instructions and images for how to search for information online and identify sources.

Navigating Community Resources. Parents sought to improve their digital literacy skills by learning from other family members, attending community center classes, and support from cultural organizations in the community. In many situations, parents benefitted from these community resources, such as informed community members and translators. However, we also identified moments when parents were often left dissatisfied because the resources available in their community did not match their needs:

Alba (F5 mother, age 51, translation from Spanish): “I was pregnant and wanted to learn, but the classes ended up being about learning how to play a <video game> on the computer to learn how to type. I wasn't learning anything. I said, I'm uncomfortable and this isn't helping me.

For Alba, she had the expectation of wanting to learn to search online, but the community center wanted to teach basic keyboard typing. We observed mismatches between expectation of the community resources and the reality of our participant's needs.

Having social connections outside of the families' immediate community was another challenge parents encountered that affected access to online resources. Parents discussed how there were online resources that

required an invitation. For example, Alicia (F21 mother, age 42) described how she struggled and ultimately failed to gain access to an online neighborhood network that would allow her to advertise her housekeeping services:

Alicia (translation from Spanish): We [with help of my daughter] created an email account because it was required to sign up to a local neighborhood website where you can post and apply for jobs. Then I tried to log in... but I could not do it... the website did not let me. I then found out I needed to be a member of the network... I am still not a member...

Even though her daughter helped her create an email account to sign up for the local neighborhood website, she did not have the social capital to gain access to this resource and make announcements.

Negotiating Structural Barriers. Trust issues were abundant when it came to healthcare information and providers. Parents expressed that they were no longer allowed to take their children with them to medical appointments due to changes in health insurance policies. However, parents did not feel comfortable asking questions to their healthcare providers through the professional language interpreters. This change in policy forced the parents to turn inside the home to answer questions:

Ariana (F19 mother, age 52, translation from Spanish): If they prescribe me medicine, I want to know what it is for, what is it going to do for me, and what it contains. I get them [my kids] to help me find this information. I ask them 'Can you tell me what is this pill for? How does it help? What harm does it cause?'

Parents continued to rely on their children to help them make sense of medical information in-between appointments. The decision to prevent children from translating stems from the concern that children are not professionally trained and lack the medical literacy to properly translate. On the other hand, representative of familism, children have strong emotional ties and physical proximity to their parents, and they can provide additional information that parents struggle to recall or explain on their own. Previous work has discussed how family members of a person with a chronic condition assist in the care and communication with healthcare providers [53,88]. Future work could examine how to combine the information children brokers provide with skilled translators, which could provide richer information to healthcare providers.

4.1.4 Technological Infrastructure Resources (Exosystem). Technological infrastructures and policies were one major exosystem factor that influenced how our families engaged in OSB. We refer to technological infrastructure as the entire collection of hardware and software technologies (e.g., mobile, desktop, smartphone, and apps), economies (e.g., price for Internet), networks (e.g., speed of Internet), broadband access, and policies that impact how families access information online. Participating families described rich media environments at home, consistent with prior research on technology adoption among Latino families [44,60]. They also navigated across multiple browsers, search platforms, websites, social media sites (e.g., Facebook), and mobile applications (e.g., WhatsApp for communicating with family abroad, Google Translate).

The majority of the families used smartphones and tablets for online searching—which is consistent with the high rate of adoption of mobile devices compared to laptops and desktops in Latino populations [93]. Youth preferred to use their own mobile device (if they owned one). But if the adult needed to retain the information to review it later, youth would complete the task on the adult's mobile device. For the minority of families that owned a laptop, we observed that for complex problems, such as completing online forms, these families would switch to a laptop. The devices available to search for information shape the process of scanning and processing information as described in IPS-I.

Negotiating Access to Information and Devices. Our findings confirm prior research on how children in lower-SES, immigrant families are more likely to use technologies collectively with family members compared to children in higher income families [73,75,76]. For example, Elena (F22 mother, age 40) described how she split her phone screen so that she and her daughter could read through information at the same time:

Elena (translation from Spanish): I was with her [daughter] and I wanted to view videos. She needed to use the phone to do her homework ... Then she said: 'Wait mom, I will help you. You will see what you want on this side of the screen and I'll be on the other half of the screen.'

We also observed both members of the dyad interacting with the phone at the same time to view information. Figure 2 shows a moment where both Sylvia (mother, age 39) and Vanessa (daughter, age 17) are both interacting with the phone, with both having a finger together on the screen. While larger screens make collaboration more feasible, co-searching on smartphones or tablets is the reality in these households. Mobile phones limit the screen size in which information will be scanned, processed, and presented when parent-child dyads search for information to answer questions about complex problems, such as learning about a newly diagnosed health condition. OSB practices are thus bounded by the limitation of smaller personal devices. Future work should evaluate how the steps identified in IPS-I are impacted by co-searching through mobile phones compared to laptops and desktops.

In addition to the device's form-factor influencing OSB, access to broadband internet affects the ability to search for information online. The majority of the families had low bandwidth internet, similar to many families with matching demographics [93]. We identified a variety of ways in which families had access to the internet, and most of these practices came out of a need to save money. Families shared home internet with a neighbor or relied only on their smartphone's data plans. Others only had access to the internet through public Wi-Fi hotspots, and another set of families would have one family member tether their phone so that others could have access to the internet. The practice of sharing devices and internet access is reflective of the collectivist nature (i.e., familism) that exist in Latino families.



Figure 2. F4 Mother (left thumb) and daughter (right thumb) thumbing the phone at the same time during a V2 search task.

Evaluating Reliability of Digital Resources. Adults consistently described their fear and discomfort regarding technology. They expressed fear towards physically breaking devices and or digitally breaking them from visiting untrustworthy websites that could install viruses:

Sofia (F18 mother, age 41, translation from Spanish): [I'm afraid]. I'll go looking for something online and then things show up. When things show up it doesn't give me a lot of confidence that this page is trustworthy.

In addition to being scared of breaking technology, adults were apprehensive about their ability to find *trustworthy* information. Adults relied on youth to download materials, navigate websites, and install mobile applications on their phones because adults felt youth knew more about how to avoid viruses and downloading software without harming their phone. This lack of trust is not unique to this community [29,54,110]. For example, Pew's national U.S. survey indicated that very few adult Americans know much about cybersecurity issues [83]. Only half of the U.S. respondents had any knowledge of phishing. Younger internet users were more likely to answer cybersecurity questions correctly. Therefore, our participating parents are cautious with websites they are accessing and want to work with their children to make sure the appropriate websites are being visited. We also found that if one parent had higher digital literacy they would teach their children skills so that children could help the other parent while searching online.

A lack of trust in the digital infrastructure meant that parents did not feel comfortable engaging in everyday e-commerce transactions such as banking, paying bills, and shopping. Only five of families stated they shopped online. Of these five families, only one mother was comfortable shopping online on her own and the remaining four relied on their children and other family members to shop online on their behalf. Having children make purchases on their parents' behalf places significant financial responsibility on children to know how to shop responsibly and to identify websites that protect financial information. Furthermore, the lack of

trust in online transactions meant that families are missing out on opportunities that could save them money and time:

Amanda (F15 mother, age 48, translation from Spanish): I tell Clara (daughter, age 19), ‘we need to come up with a system where you are in charge of paying all the bills’. And she says: ‘Yes, mom, we could do it online’. And I tell her: ‘well, why don’t you learn how to do that? Help with that.’ ... Because I don’t see the point of wasting time and gas on this. I have to be driving around to pay on thing here and another thing somewhere else.

We also found that families trusted their online social networks on topics that ranged from nutrition to job searching. For example, parents talked about learning about nutrition through videos posted on Facebook. However, the lack of regulation on digital information means that while social media networks allow people to share information with their friends and family, they also make it difficult to know what information is reliable. Furthermore, to make the information easier for parents to read, children would present information in the form of videos and infographics without verifying if the source is reliable.

4.2 OSB as a collaborative information problem-solving process

In the previous section (4.1), we situated OSB within a socioecological context. In this section, we operationalize OSB and demonstrate how it occurs in practice through three specific search vignettes. We captured these vignettes through direct observation of imposed, historical, and open-ended search tasks in the second home visit. We apply specific IPS-I skills (defining information problem; scanning information; processing information; organizing and presenting information) to distill the process of OSB, highlight breakdowns, and illustrate the complexity of bilingual intergenerational collaboration in the three representative cases.

4.2.1 Vignette #1: Searching for Clients for Father’s Business (Defining Information Problem). In family F22, Yara (daughter, age 16) helped Elena (mother, age 40) search for construction clients for Pablo (father), who recently became a licensed contractor specializing in siding. Elena wanted to help her husband find new clients, and asked Yara to help. This vignette highlights collaborative efforts to define the information problem and identify appropriate search terms:

Yara was using a desktop computer and her mother looked at the screen over her shoulder. In Spanish, Elena asked Yara to search for “trabajos en construccion” (‘construction jobs’) for Pablo. Yara typed in the desktop browser’s search bar in English: [construction companies hiring near me]. She then selected the option in the results page, which led her to Monster.com (a job search portal). On Monster.com’s search query textbox, Yara typed: [construction]. When the results appeared, Yara selectively translated out loud, from English to Spanish, job titles she thought were appropriate for her father.

Yara used her language and digital brokering skills to: 1) translate her mother’s request from Spanish to English; 2) define the problem to search; 3) determine the appropriate query (and specifically localized results by adding “near me” to the search); 4) identify Monster.com as a website that would provide further resources; and 5) translate relevant information back to Spanish to share it with her mother. During this process, Elena was co-viewing the computer screen and talking through the process with Yara, but seemed comfortable with Yara making decisions:

*Elena suggested to add the term “siding” to the search query. Yara typed: [construction **citing**] (sic) which did not yield desired results. Yara asked: “¿Cómo se escribe ‘siding’?” (How do you spell ‘siding’?). Elena looked through Pedro’s paperwork to find the word (see Figure 3). Elena told Yara the correct spelling and Yara typed: [construction companies in need of siding installation] to restart her search.*



Figure 3. F22 Mother pointing at paper on the wall to show her daughter the spelling for siding during a V2 search task.

Elena requested to add a word to the search but neither her nor Yara knew how to spell it. As described in the IPS-I model, the process of problem-solve information through the internet is dependent on literacy skills. The misspelling of siding caused the search results to yield undesired outcomes. Once they figured out the spelling and searched again, Yara identified a website she thought would be useful:

Yara clicked on an Indeed.com link (job website), which yielded job postings with words she and Elena considered similar to Pablo's skills. Like before, Yara continued to sift through the job listings to decide which job postings were a good match to translate into Spanish.

Elena then asked: "¿Cuánto pagan?" (how much do they pay?). Yara quickly replied in Spanish: "\$20 por hora" (\$20/hour). Elena realized that they needed to do a different search because the salary for the position did not match her knowledge of how much Pedro could be paid as a contractor. At this point, Elena explained to Yara that she wanted to find subcontracting work for Pablo's business and not a job for individual hire. Yara got stuck and expressed frustration through her body language because she was not sure how to search for that. At the end, Yara rated this task as medium difficulty.

Summary Analysis of Vignette #1. This vignette is an example of a collaborative attempt to define an information problem and identify appropriate queries. Elena's struggle to describe the information need caused difficulty for Yara to identify the proper search terms. The poor description of the problem and misspellings created cascading effects that made it difficult for Elena and Yara to find contracting opportunities for Pedro. This case is also an example of how intergenerational collaboration can leverage individual-level skills of each family member to support family information needs. Yara knew about Indeed.com as a job resource; she shared that knowledge with her mother as they worked together to support her father.

4.2.2. Vignette #2: Understanding a Health Diagnosis (Scanning and Processing Information). This second vignette is an example of a parent-child dyad trying to make sense of health information together. The problem this family, F21, was trying to solve was caused by a social-ecological issue: a new change in health policy prevented minors from accompanying their ELL parents to act as translators. Cristina (daughter, age 16) could no longer accompany her mother, Alicia (age 42), to her medical appointments. At a recent appointment, the medical center provided Alicia an interpreter, but she struggled to understand and explain herself through the interpreter. While professional medical translators have training, they lack trust with ELL patients and may not have knowledge of specific language cues. Alicia gathered the diagnosis information in English from the doctor, and later asked Cristina to help her interpret that information:

Alicia asked Cristina about a medical phrase in English. Cristina took her mother's smartphone and typed the word as she could discern based on her mother's pronunciation. Together they figured out the word Alicia was referring to was 'liver'. Alicia did not know if 'liver' was a part of the stomach or her kidney, and Cristina did not know how to describe the liver organ. On her mother's phone, Cristina searched for: [liver translation into Spanish] which they learned translates to 'hígado'.

Cristina tried to search in Spanish for the complete English phrase the doctor used: [inflammation of the liver]. But she got stuck when trying to spell the phrase in Spanish, and then handed over the phone to Alicia. Alicia typed: [razones que causan inflamación del hígado] (causes of liver inflammation) while Cristina helped her type. After Alicia entered the phrase in Spanish, Cristina took back the smartphone to sift through the results. Alicia said in Spanish to the researcher: "There are a lot of options and sometimes you click on things that seem like adult content, that are unrelated, or that cause even more concern!"

In this case, defining the problem and the search terms seemed straightforward. However, neither Alicia nor Cristina had background knowledge on the topic that could provide context to scan and process information. Christina's own digital literacy skills (reinforced by her father) ultimately facilitated the collaborative search and illustrate the family's collectivist orientation:

Cristina selected a link that had the word 'inflammation' in the description under the link. She added: "My dad taught me to look where the links come from. For example, this one I can see is coming from the Cancer Society and this other link I don't know where it's coming from." Alicia said that she gets overwhelmed when health search results don't lead her to what she wants to know.

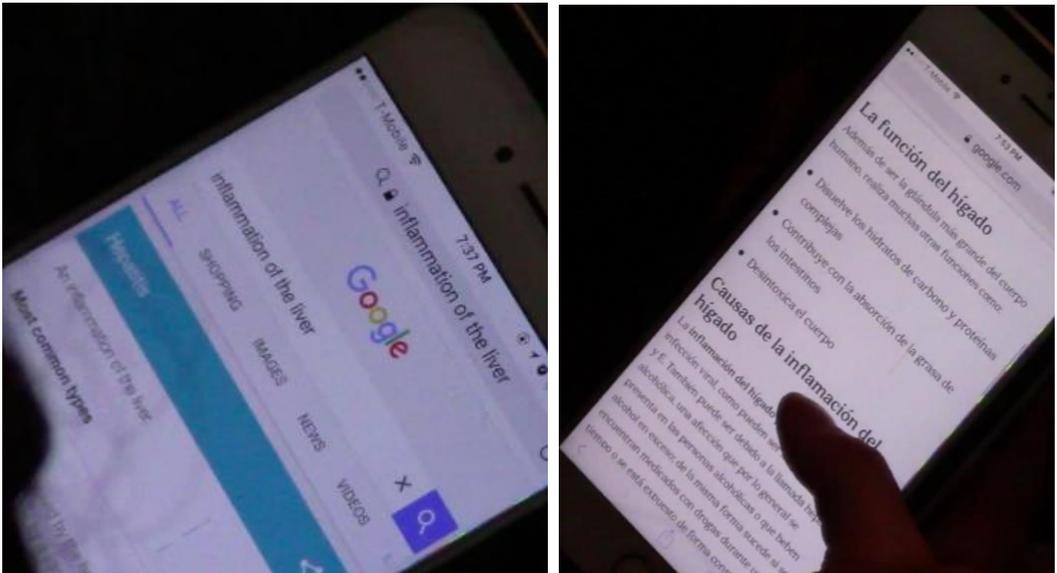


Figure 4. F22 Cristina searching for information in English from a website she trusts (left) to then find similar information from a website in Spanish (right).

Summary Analysis of Vignette #2. In this vignette, structural issues in health policies further made this OSB interaction more complicated. Researchers have documented how professional interpreters facilitate information exchanges between non-English speaking patients and English-speaking medical providers [19,64,120]. However, in-person interpreters join at the start of the appointment and there is limited time to build rapport with the ELL parent during the appointment. Prohibiting children to be at the appointment created obstacles for this family. The daughter, Cristina, is receiving the information problem request secondhand from Alicia, rather firsthand from the provider. As this case illustrates, the scanning and processing of high

priority medical information is occurring at home, and often navigated collaboratively by parents and children. Figure 5 shows how Cristina navigates information in English and in Spanish to make sense of what her mother needs help with and find a source in Spanish that is equivalent to that she read in English.

4.2.3 Vignette #3: Online Shopping & Decision-making (Organizing and Presenting Information). In family F5, Javier (father, age 50) asked his daughter Ana (age 16) for help with shopping for a new cooking grill:

Javier (father, age 50) wanted to look for online deals for outdoor cooking grills. Ana (daughter, age 16) went to the retail website requested by her father and found ‘weekly deals’ on the front page. When she asked Javier what exactly he was looking for, Javier just replied, “búscame la más barata” (find me the cheapest). Ana selected the ‘Deals’ button on the website, asking her dad at every level (result or new menu) what he was looking for (e.g., size, price, capability, brand). Once Ana had a list of results, she sat next to Javier so that they could view the results together. Ana could not find discounted grills. She eventually took back the phone so that she could navigate the search on her own. After browsing through three different menus, Ana finally found the category for grills. She brought Javier back into the process to review the options one by one.

While online browsing and shopping may seem like a straightforward process, Javier needed his daughter’s help to navigate different product choices online. Yet Ana could not drive the search without direct input from her father to narrow down his goal. Figure 5 shows Ana selecting grills and Javier overlooking her selections. This was a common process that Javier and Ana engaged in when making purchasing decisions.

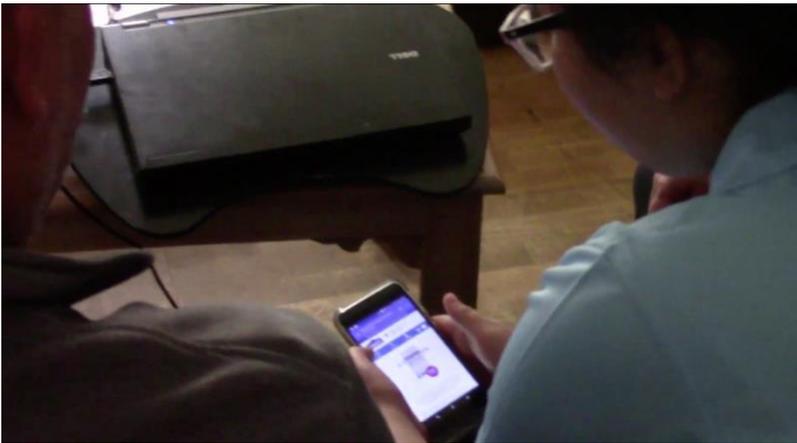


Figure 5. F5 Javier (Father) viewing the choices Ana (daughter) selects during a V2 search task.

They collaboratively searched for information, but Anna took the lead in organizing and presenting it. In this case, their collaboration continued offline as Ana brought her language brokering skills into the fold:

Once Javier settled on a grill, Ana took a screenshot of the page with the item information. Ana later explained that she went to the store with Javier to purchase the item in person. Both Javier and Ana explained that they do not purchase items online. Once at the store, Ana used her language brokering skills to help her father communicate with the store clerk to find the exact grill Javier was looking for.

This representative case indicates a notable difference between OSB and language brokering. In this vignette, Ana went through the IPS-I processes of defining the information problem, searching information, scanning information, and presenting information. However, she also had to collaborate with her father to regulate the search, particularly regarding the financial decision-making aspect of their goal. This type of collaboration across multiple settings has not explored before with respect to IPS-I, and moves beyond the traditional role of children as language brokers.

Summary Analysis of Vignette #3. In this vignette, we noted two sets of interactions influenced by ecological factors. First, Ana and Javier had to make a financial decision together. While adults make the final financial decision, youth brokers are privy to the nuances of family finances. Throughout our study, parents openly discussed affordability and household budgets with their children. In these moments, OSB interactions transcended a space of information-gathering as the adult and youth would come to a decision together. Second, additional offline work was required because this family (like others), worried about online financial transactions—a pattern we noticed across all participating families. Just simply finding the online deal was not enough, the completion of the task happens when Ana and Javier go to the store to purchase the item. In Ana and Javier’s case, the presentation and organization of the information involved 1) taking a screenshot of the search results for her father (information and technology brokering); and 2) bringing this screenshot to a store act as interpreter between the clerk and her father (language brokering).

5 DISCUSSION

Previous work on language and technology brokering in families with lower-SES, immigrant, ELL parents has emphasized the prevalence and nature of the child brokering phenomenon [25,59,85,87]. Much of this research also approaches brokering from an individual- or family-level perspective. By identifying the socioecological factors that shape the *process* of collaborative online information seeking, we contribute a novel perspective that acknowledges the complex role of children in addressing family information needs. Our work has demonstrated that in addition to language and technology skills, OSB also requires digital literacy, problem-solving skills, community resources, and technological infrastructure to facilitate online information problem solving. By combining ecological and information problem-solving theoretical frameworks, our findings reveal important implications for how bilingual, lower-SES families with immigrant parents can be supported in their efforts to navigate digital information.

Brokering among youth in immigrant families is now more digital. The role of youth brokers in the digital age is multi-faceted. They need to be able to identify search terms that are relevant to adult’s query, even adults struggle to understand or describe the information problem. Then, youth need to scan the results based on the search terms entered, but many topics are technical and jargon-like (e.g., medical prescriptions, job searches, politics). Finally, youth brokers have to decide which website (or what mobile application to use) based on: (1) what the child deems trustworthy, and (2) what presentation modality (e.g., infographic, video, or bulleted text) youth think adults will feel most comfortable reading. If youth are struggling at any of these stages of the IPS-I model, there can be cascading effects that lead to: (1) not finding the desired information, (2) dissatisfaction with the information found, or (3) accessing potentially incorrect or misleading information. Therefore, we argue that youth brokering is no longer just about language [85,86], but instead is deeply connected to digital literacy, technology access, and family and community resources.

Intergenerational OSB can impact family wellbeing. The intricate interactions that occur between parents and children during OSB is a form of Joint Media Engagement (JME) that has not been studied. Previous work on the uses of technology within families has mainly studied middle and higher-SES families’ collective use of traditional and digital media, particularly for educational purposes [105]. We posit that while lower-SES families have similar uses and experiences to higher-SES families with respect to using technology (e.g., learning together, staying connected, and playing together), OSB is a common practice particularly in lower-SES immigrant families that carries important implications to the family’s wellbeing. The challenges ELL parents face when interacting with institutions, and the trust parents place on their children to find and interpret information on critical topics such as diagnoses and prescriptions, highlights the importance of including children in socio-technical interventions. This research demonstrates that JME is not just about entertainment [101], digital reading [90,91], and educational media [7]. We believe research in JME needs to consider how work and responsibilities can be a part of digital family learning. Future work should explore how to support improving IPS-I skills for both adult and youth, particularly among families in which the phenomenon of OSB might be prevalent.

OSB should be studied as a form of collaborative search. As technologies become more ubiquitous, online searching is becoming more of a collaborative endeavor [77]. Collaborative search has focused on supporting peers [3,75,76,79,106] and building tools for social searching (e.g., Coagmento [74], HeyStaks [100], and So.CI [35]). Our findings provide a new research avenue for designing collaborative search interfaces that support intergenerational and bilingual co-searching on mobile platforms that can benefit searchers with different skillsets. Collaborative search has become more prevalent as a technological

phenomenon [77], but the design of browsers and search tools still assumes solitary usage [77]. We posit that search interfaces could be *designed to bring families together*. Designing for intergenerational search could help family members learn from each other. The shared information interface could reinforce intersubjectivity [103] by supporting searchers of different abilities and skills. Our findings suggest that bilingual families often collaborate using smartphones and tablets through turn-taking, passing devices back and forth, splitting screens, and sharing screenshots. Design solutions that display search results across two devices may support synchronous co-located searching.

Macrosystem factors impact literacy skills and family practices. Finally, our findings demonstrate how the macrosystem level is interconnected with the meso- and micro-levels, and that together they impact both individual digital literacy skills and family-level OSB practices. This study contributes to the literature by examining how youths' obligations to their ELL families influences how families collaborate together. Online information problem solving is not just a purely cognitive task; instead, we argue the emotions and affect [6], filial piety, and acculturation all play an influential aspect on OSB. Future work should trace the connections through the various layers of EST to family information problem solving in online spaces. While familism as a cultural macrosystem factor has been studied as an influence on adolescent behavior [71], mental health [117], and schooling [28], less is known about its effects on technology usage and information problem solving. Future work could study the impact of strong and weak ties, contestation, and negotiation representative in familism impacts OSB.

6 LIMITATIONS AND FUTURE RESEARCH

Our case study focuses on a small sample of 23 lower-SES, bilingual, Latino families with ELL parents. The presence of researchers during the observed search tasks may have influenced how in-home searching occurred. The goal of this research is towards theoretical generalizations, not statistical generalizations [116]. Similarly, this study on Latino families is by no means representative of all youth brokers and their families. To capture the full range of diversity in online brokering activities, future work should examine brokering practices between youth and ELL adults in other cultures and languages. Third, future work should further disaggregate the Latino community based on country of origin (e.g., Mexican, Dominican, Ecuadorian) and region where they reside in the U.S. Fourth, while the search tasks were not captured organically, by engaging in multiple home visits and allowing families to discuss experiences in searching we argue that our methods allowed us to approximate prior searches.

Future research could explore capturing searches and brokering interactions in situ through recording audio data and conversations around digital voice assistants [89]. However, we need to consider: (1) if passive background recordings at home will provide higher quality evidence while still ensuring families feel safe and protected, (2) providing agency to families to decide if they want to be recorded at certain times and what data to provide to researchers. Finally, our study ($N = 50$ participants) had a larger sampling of adult women ($n = 20$) and daughters ($n = 15$), than adult men ($n = 6$) and sons ($n = 9$). This was a convenience sample and prior research has documented this gender bias in recruitment efforts [46]. It is too early to speculate as to why OSB responsibilities tend to be reserved for specific household members based on age and gender. Future work should explore the intersection of gender and OSB responsibilities to unpack the division of labor and responsibility in ELL families.

7 CONCLUSION

Our work has examined how families use technology to access and interpret information that impacts family wellbeing. In particular, we have focused on an understudied community in HCI and CSCW, lower-SES Latino youth (ages 10 – 17) with immigrant ELL family members. To meaningfully engage this understudied group, we visited families' homes multiple times to conduct interviews and observe search tasks in the environment where OSB often takes place. Guided by EST, a socioecological framework [14,104], we identified factors that impact intergenerational information seeking and problem solving in online spaces. Our findings demonstrate that adults and youth leverage skills and resources in the microsystem (e.g., family), the mesosystem (e.g., community and institutional), the exosystem (e.g., infrastructure), and that their OSB practices are embedded in cultural dimensions (e.g., familism) of the macrosystem.

The research design we deployed allowed us to document individual perspectives on the nature and frequency of OSB, and to capture the actual moments of collaboration that make OSB a compelling phenomenon. By analyzing these moments through an information problem solving lens [13], we were able to cultivate new conceptualizations of collaborative online search, information processing, and youth brokering.

Such an approach demonstrates how lower-SES bilingual families leverage the resources that are available to them and creatively find ways to address family needs by meaningfully engaging digital tools. While these efforts are certainly not always seamless or successful, they highlight cultural and value-based assets that counter deficit notions of how marginalized groups will fare in an information economy.

Furthermore, OSB practices in Latino families suggest implications for how to study and design technology for family use. Our research has demonstrated that information access and learning occur bidirectionally in these families—parents are learning from children and vice versa. OSB practices thus reveal a form of technology engagement that is influenced by familism. The extent and nature of children’s household responsibilities is largely shaped by the realities of their parents’ work conditions, the unique needs of the family, and the structural conditions that position children as resources. In the digital age, youth’s technical skills lead them to move from language brokers to information searchers and brokers. As an extension of children’s household tasks, OSB thus occurs as a necessity and is shaped by both cultural values and social-ecological conditions. Such a shift calls for re-conceptualizations of technology engagement among families. CSCW and HCI researchers need to centrally consider the broad range of family responsibilities that are part and parcel of youth’s technology engagement in digital age. Such considerations can stimulate equitable programs, tools, and interventions that support the information needs of disadvantaged groups.

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