

Youth invisible work: the sociocultural and collaborative processes of online search and brokering between adolescents and English-language learning families

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Received 11 January 2022
Revised 28 May 2022
16 June 2022
Accepted 17 June 2022

Abstract

Purpose – This study aims to investigate the collaboration processes of immigrant families as they search for online information together. Immigrant English-language learning adults of lower socioeconomic status often work collaboratively with their children to search the internet. Family members rely on each other's language and digital literacy skills in this collaborative process known as online search and brokering (OSB). While previous work has identified ecological factors that impact OSB, research has not yet distilled the specific learning processes behind such collaborations.

Design/methodology/approach – For this study, the authors adhere to practices of a case study examination. This study's participants included parents, grandparents and children aged 10–17 years. Most adults were born in Mexico, did not have a college-degree, worked in service industries and represented a lower-SES population. This study conducted two to three separate in-home family visits per family with interviews and online search tasks.

Findings – From a case study analysis of three families, this paper explores the funds of knowledge, resilience, ecological support and challenges that children and parents face, as they engage in collaborative

The authors would like to acknowledge their community partner, the Latino Educational Training Institute (LETI), and all the families and children who participated in this research. The authors would also like to thank Dr Lori Takeuchi and Dr Vikki Katz for their intellectual guidance and mentorship. This work was financially supported by a Google Faculty Research Award, a University of Washington Royalty Research Fund Award, a National Science Foundation Graduate Research Fellowship and a National Science Foundation CAREER Award: #1941679.



OSB experiences. This study demonstrates how in-home computer-supported collaborative processes are often informal, social, emotional and highly relevant to solving information challenges.

Research limitations/implications – An intergenerational OSB process is different from collaborative online information problem-solving that happens between classroom peers or coworkers. This study's research shows how both parents and children draw on their funds of knowledge, resilience and ecological support systems when they search collaboratively, with and for their family members, to problem solve. This is a case study of three families working in collaboration with each other. This case study informs analytical generalizations and theory-building rather than statistical generalizations about families.

Practical implications – Designers need to recognize that children and youth are using the same tools as adults to seek high-level critical information. This study's model suggests that if parents and children are negotiating information seeking with the same technology tools but different funds of knowledge, experience levels and skills, the presentation of information (e.g. online search results, information visualizations) needs to accommodate different levels of understanding. This study recommends designers work closely with marginalized communities through participatory design methods to better understand how interfaces and visuals can help accommodate youth invisible work.

Social implications – The authors have demonstrated in this study that learning and engaging in family online searching is not only vital to the development of individual and digital literacy skills, it is a part of family learning. While community services, libraries and schools have a responsibility to support individual digital and information literacy development, this study's model highlights the need to recognize funds of knowledge, family resiliency and asset-based learning. Schools and teachers should identify and harness youth invisible work as a form of learning at home. The authors believe educators can do this by highlighting the importance of information problem solving in homes and youth in their families. Libraries and community centers also play a critical role in supporting parents and adults for technical assistance (e.g. WiFi access) and information resources.

Originality/value – This study's work indicates new conditions fostering productive joint media engagement (JME) around OSB. This study contributes a generative understanding that promotes studying and designing for JME, where family responsibility is the focus.

Keywords Children and families, Information problem-solving, Internet searching, Joint media engagement

Paper type Research paper

1. Introduction

Socioeconomic status (SES) inequalities are increasing among the US families (Islam and Safavi, 2019), leading to increased pressure for families with lower-SES backgrounds to find ways to manage their well-being. Adult family members rely on their children to collaboratively care for critical family needs, depending upon youth's invisible work, such as youth working multiple jobs (Lerman, 2000), being caretakers (Hafford, 2010) and translating (Guan *et al.*, 2014). In the digital era, information communication technologies (ICTs) are integrating into the livelihoods of families. Specifically, ICTs now play a larger role in collaboration among diverse families, such as digital media brokering (Katz, 2014), children teaching parents how to use technologies (Correa, 2014) and families using social media for transnational communication (Garg and Sengupta, 2019). ICTs generally allow families easier access to digital information, but obtaining and interpreting reliable information can also be challenging (Pina *et al.*, 2018).

Today, approximately 8-million US children have at least one immigrant parent who is an English-language learner (ELL) (Zong *et al.*, 2018). Lower-SES immigrant parents often rely on their children's language and digital literacy skills to address family needs (Gonzalez *et al.*, 2020; Eksner and Orellana, 2012; Katz, 2014). Adults and children work together to search the internet, in a collaborative information problem-solving process we call online search and brokering (OSB) (Pina *et al.*, 2018; Yip *et al.*, 2016). Children's responsibilities extend beyond traditional chores to acting as the primary problem-solver when searching

for information regarding critical family needs online. While online information problem-solving models (Brand-Gruwel *et al.*, 2009) contribute to our understanding of digital learning and information processing, they do not fully explain the sociocultural and collaborative learning processes that occur as families engage in OSB and JME processes. OSB processes fit into the context of traditional cultural and language brokering (Corona *et al.*, 2012; Orellana, 2003), but our emphasis is on how these processes are dependent on technology usage.

Joint media engagement (JME) is the phenomenon in which people use digital media to collaborate and learn together, including viewing, playing, searching, reading and creating (Takeuchi and Stevens, 2011). As technology becomes more ubiquitous, JME has expanded to encompass “all forms of media, especially those that dominate young people’s time and experience.” Under JME, both children and adults in a household are learners together (Reiser *et al.*, 1988; Stevens and Penuel, 2010; Takeuchi and Stevens, 2011). Research on JME focuses on family entertainment, relationship development and educational value (Gee *et al.*, 2017). However, JME can take on high stakes set of household responsibilities with ICTs (Katz *et al.*, 2018).

This investigation focuses on the JME learning processes that emerge during online collaborations among lower-income bilingual families. Latino children are projected to comprise about a third of K-12 enrollment by 2023, and with more than half living with immigrant families (Foxen and Mather, 2016), many are searching for critical information online for their ELL family members. Researchers engaged in sociocultural historical approaches with children from non-dominant backgrounds explain learning as an ongoing process rather than divided into distinct characteristics of individuals and contexts (Gutiérrez and Rogoff, 2003). Our research explores a new avenue in JME research by examining how families learn collaboratively through engagement in family work.

Previous research on households traditionally viewed as low-resourced applies a funds of knowledge framework to understand and nurture often overlooked strategic knowledge and skills (Moll *et al.*, 1992). Similarly, researchers use an ecological systems framework to explain support and challenges to OSB (Pina *et al.*, 2018) and how families develop and use resilience against difficulties (Patterson, 2002). We propose JME processes around family work can integrate these frameworks. Our research questions are:

- RQ1. What funds of knowledge do bilingual children and their English language learner parents rely on when attempting to solve information problems using the Internet?;
- RQ2. What are the collaborative learning processes around online information searches in ELL families as they work together?; and
- RQ3. How do socio-ecological supports, funds of knowledge and family resilience strategies support joint media engagement processes around family information work?

Our research makes two contributions. The first is a new empirical understanding of how situational contexts, systems and histories shape the way Latino ELL parents and children engage in learning processes around OSB. This understanding can help us reflect on how to design and support appropriate collaborative learning processes for lower-SES, ELL, immigrant parents and their children. Second, we propose a new theoretical JME framework that integrates funds of knowledge (Moll *et al.*, 1992), ecological systems theory (Pina *et al.*, 2018) and family resilience theory (Patterson, 2002) to explain how families collaboratively learn around family responsibilities. We surface new conditions that fostered productive

JME (Takeuchi and Stevens, 2011) in families. We contribute a generative understanding that promotes studying and designing for JME among family members, where family work differs from normative notions of JME for entertainment and education.

2. Background

2.1 *Digital literacies and lower-socioeconomic status families*

Social media usage within families in historically marginalized communities has indicated new ways of transforming collaborative learning. Cybart-Persenaire and Literat (2018) examined how mobile technologies impacted historically marginalized students in a high school journalism class. They highlight how mobile technologies generated new transformative identities, particularly the conception of self, classroom, peers, community and family. In Madge *et al.*'s (2019) case study of African International Distance Education, researchers examined WhatsApp (social media) for learning as it became an important way for families to connect with students. Research on *Vine.com* (social media for micro-video sharing) found Latinx bilingual youth can develop critical literacy practices (de los Rios, 2018), particularly around their families' experience with police as unarmed people of color and unequal gender roles. Vacca (2019) worked with Latina teens to develop memes as digital tools to challenge parents about adolescent behaviors. The youth argued digital tools for learning can be used for creative argumentation. Parents perceived digital experiences as ways to engage in deeper conversation with their daughters, demonstrating the power of Latina youth to construct their own media messages for their parents. These studies present technologies as supporting identity development in family spaces, relationship building and youth as creators. However, few socio-technical innovations for youth's invisible work have been developed to help families learn together and self-regulate critical information seeking practices.

2.2 *Youth's invisible work and information communication technologies*

For humans to survive, they depend on the daily routine activities that feed, clothe, shelter and care for children and adults. Family work (e.g. household labor) is the unpaid (and often invisible) labor that is needed to maintain the status and well-being of household members and/or the home (Shelton and John, 1996). While family work is known to be gendered and done predominantly done by women (Coltrane, 2000), children are also a part of the family work system. Researchers have documented youth's invisible work for their family well-being, such as taking care of younger siblings (Hafford, 2010) and siblings with chronic illness (Carter, 2005). Others highlight youth's role in household responsibilities (East and Hamill, 2013), as translators for English-language learning parents (Dorner *et al.*, 2008) and as cultural brokers (Trickett and Jones, 2007). However, youth engaged in persistent invisible family work have developed higher risks of depression/anxiety (Morales and Wang, 2018), substance abuse (Kam and Lazarevic, 2014) and suicidal ideation (Zayas *et al.*, 2009). When moderated, youth's invisible family work has shown stronger parent-child bonding (Weisskirch, 2010), higher self-efficacy (Crafter *et al.*, 2017) and academic success (East and Hamill, 2013). This research examines what supports can be developed so youth engaged in these practices feel empowered in their families.

Youth's invisible work in families is reliant on ICTs. Katz *et al.* (2018) noted this phenomenon as families in historically under-served communities are now integrating technology into their support systems. As information resources become digitized, parents' jobs, health and finances are now dependent on technological infrastructure (Katz and Gonzalez, 2016). Latinos are adopting ICTs at equivalent or higher rates to other ethnic groups (Lopez *et al.*, 2013). Other lower-SES families are following similar patterns, such as

increased rural broadband (LaRose *et al.*, 2007) and growing smartphone usage (Marler, 2018). While studies have been conducted on how youth broker family information (Corona *et al.*, 2012; Orellana, 2003), we have little knowledge on how to integrate this knowledge into the design of sociotechnical systems and policies, especially as lower-SES families are at higher risk of misinformation (French and McKillop, 2016).

2.3 Individual and collaborative search processes

While studies have been conducted on how youth broker information for lower-SES families (Corona *et al.*, 2012), the process of how OSB happens is less known, particularly for learning. Models like *Information Problem-Solving for the Internet* offer insights into the set of skills individuals need to search for information online. These skills include defining, searching, scanning, processing and organizing information (Brand-Gruwel *et al.*, 2009). Collaborative online searching (Morris, 2013) provides an opportunity to reinforce and learn search skills from exposure to others' strategies (Foss *et al.*, 2013). This work has focused on skilled peer adults searching remotely together using online tools (Morris, 2013).

As families collaborate to address family needs in everyday language-brokering events, different levels of abilities are leveraged and knowledge becomes co-constructed (Eksner and Orellana, 2012). Scholars have explored how children become technology brokers to teach their parents new technologies (Nelissen and Van den Bulck, 2018). There are significant differences in how children help their parents with technology across families of different SES (Brown *et al.*, 2007). In higher-SES families, children drive adoption of mobile applications and technology for entertainment and educational purposes. However, for families of lower-SES status, children help connect their adult family members to critical information needs (Nelissen and Van den Bulck, 2018).

3. Theoretical framing

The nuanced interactions that occur as parents and children engage in OSB is a form of JME (Pina *et al.*, 2018). Takeuchi and Stevens (2011) describe 'productive JME' as design and situational conditions that allow for optimal collaboration with technologies. Our study examines the interactions occurring around collaborative learning processes of JME. We follow Takeuchi and Stevens' (2011) call to build knowledge about how to foster productive JME in diverse family contexts. We build our analysis on JME for family work from three frameworks: ecological systems theory, funds of knowledge and family resilience.

Ecological systems theory explains children and families' interactions with digital media and technology as being shaped by interconnected ecological layers (Bronfenbrenner, 1977). We know from ecological systems theory that while families rely on digital literacy practices from youth, invisible work is not purely an individual cognitive task (Pina *et al.*, 2018). On a macrosystem level, cultural values such as familism influence needs and responsibilities for youth doing invisible work. Exosystems, such as technological infrastructure and policies indicate the role of design. Mesosystems demonstrate the role of community centers, libraries and schools influencing how youth are supported. Finally, individual abilities (e.g. digital literacies, language) exist as microsystem factors.

Funds of knowledge offer an asset-based perspective to understand historically accumulated and culturally developed bodies of knowledge essential for household and individual well-being (Moll *et al.*, 1992). Funds of knowledge approaches allow us to better interpret the tacit knowledge families and children draw on when engaging in invisible work (Roldan *et al.*, 2019). Often, this knowledge is not explicitly taught; a person's funds of knowledge can be described as their accumulated life experiences, the skills and knowledge

they use to navigate life and their cultural-historical academic and personal background knowledge (Moll *et al.*, 1992).

Family resilience theory (Patterson, 2002) focuses on outcomes of interest at the family system level. Resilience at the family level emphasizes identifying protective factors and processes that moderate a family's relationship to significant risk and abilities to accomplish family functions during stress. Family resilience is a process, not a trait. As families rely on youth to do invisible work, they work as a group to discover new resources to manage challenges and cope with situations to develop meanings on their own family's identity.

4. Methods

For this study, we adhered to practices of a case study examination (Merriam and Tisdell, 2015). Between July 2016 and June 2017, we visited 23 families in an urban area in the Pacific Northwest, USA, within a 32-kilometer radius of our research institution (Pina *et al.*, 2018; Roldan, 2021; Roldan *et al.*, 2019).

Our participants included parents, grandparents and children 10–17 years of age. Most adults were born in Mexico, did not have a college-degree, worked in service industries and represented a lower-SES population. During this study, a tense political climate existed for Latino families. Immigrant communities in the USA often do not trust researchers and institutions because of a history of exploitation. To establish rapport and trust, we partnered with a Latino-serving nonprofit community organization and recruited participants at local cultural events. We financially compensated our community partner for their efforts in recruiting eligible families. The executive director of the organization also made recruitment phone calls to families she knew personally to describe the study and invite them to participate.

We conducted two to three separate in-home family visits per family. In-home visits allowed participants to feel comfortable in their usual search and brokering environment and allowed researchers to observe search practices within home's digital infrastructure. In our first in-home visit (V1), we conducted separate adult and youth retrospective interviews to contextualize where and how they search. We adapted an interview protocol from previous work on in-home media studies (Katz and Gonzalez, 2016) to gather family members' perspective on their practices, strategies and challenges when searching for information online. Each interview (45–60 mins) was audio recorded and transcribed. Parent interviews were in Spanish and youth interviews in English. For our second in-home visit (V2), we focused on directed internet search tasks between adult-youth dyads. We recorded audio and screen interactions. In V2, participants engaged in a set of imposed search tasks prompted by researchers and historical tasks of prior online searches. Visit 3 (V3) focused on reviewing prior searching during the recent month of our visits. To ensure construct validity in our case study, we focused on triangulation of different sources of data, such as parent/child interviews, search tasks, audio and screen interaction and a review of recent prior searching (Gibbert and Ruigrok, 2010; Yin, 2011). Conducting three separate visits also allowed us triangulation between the interviews and tasks. This study is situated in a larger investigation on immigrant Latin American families and their online search and brokering behaviors (Gonzalez *et al.*, 2020; Pina *et al.*, 2018; Roldan, 2021; Roldan *et al.*, 2019). This paper provides a more focused analysis on the specifics of joint media engagement (Takeuchi and Stevens, 2011) as it pertains to family work.

In comparison to our other investigation on 24 families (Pina *et al.*, 2018; Gonzalez *et al.*, 2020), for this paper, we selected three focal families as case studies (Table 1). While not representative, these three focal families reflected patterns observed in other families (Pina *et al.*, 2018). First, we selected families that offered insights into different household

structures that influence OSB processes. In a comparative analysis, these families showed us themes in funds of knowledge used and learning processes. Each family offered insights into different types of devices used in homes to search for information. Finally, each of these three families allowed us three separate visits (V1–V3), so that we were able to spend more time understanding their lived experiences.

To analyze the data, two researchers used open coding with constant comparative analysis (Merriam and Tisdell, 2015). Two researchers open-coded the data independently for themes such as technology and language brokering, information problem-solving, perceptions of learning and strategies and challenges to searching. We coded and compared themes to develop further categories for analysis and then systematically compared and contrasted themes. To ensure inter-reliability, our team examined the codes and initial theme together. We had several group meetings in which the authors of this paper discussed and conducted multiple rounds of coding, meeting, diverging, revising and synthesizing the coding (McDonald *et al.*, 2019). Following open coding, we used axial coding to make connections between our three frameworks. We performed a constant sorting and comparative analysis until theoretical saturation was reached and no new codes were generated.

5. Findings

We present three cases of families collaborating in situations of need. First, we provide a descriptive narrative of the search that families are engaged in through JME. These searches range from lower- to higher-priority needs. All names are pseudonyms. We use superscript A (Name^A) to indicate adults and superscript C (Name^C) to indicate children. Second, we analyze each case in the following manner:

- through a funds of knowledge lens of children and adults;
- through an ecological systems theory perspective (challenges faced together by each family and support systems);
- by highlighting resilient behaviors in children and adults; and
- by naming key aspects of collaborative online problem solving.

5.1 Case 1. Brittany^C and Marisela^A

5.1.1 *Context of joint media management interaction.* Brittany^C (age 13) is a resourceful searcher who helps her mom Marisela^A with online searches. Both Brittany^C and Marisela^A indicated they were intermediate in their technology skills. Brittany^C's favorite device is her iPad and she recalled first using computer technology in preschool (Plate 1). Marisela^A was aware of the technology resources available in her community, having lived in the USA for

Table 1.

Demographics of three case-study families. In education level, primary refers to 1st through 6th grade and secondary refers to 7th through 12th grade

Age, relationships and grade completed	Occupation	Country of origin
Marisela ^A (41, mother, secondary)	Housekeeping	Mexico
Brittany ^C (13, daughter, 8th grade)		
Elvia ^A (45, mother, secondary)	Housekeeping	Mexico
Dulce ^C (16, daughter, 11th grade)		
Carmelo ^A (56, grandfather, secondary)	Food service	Honduras
Mateo ^C (12, grandson, 7th grade)		



Plate 1.
Brittany^C and
Marisela^A during our
first visit

more than 15 years. She relied mostly on her smartphone. Brittany^C and her two sisters helped their parents translate words using ICTs.

During the V3 session, Marisela^A and Brittany^C shared a story about their recent family vacation. They had spent a week driving through Nevada and California and Brittany^C used her iPad to navigate. The family mentioned a time that they had to tell the hotel that their key was not working. Brittany^C shared that when she has a hard time translating, she uses translation apps on her mom's smartphone. As the two searched online, they noted that spelling and poor Internet hindered their success. Even with technological challenges, the dyad persevered to keep searching even when they might not know exactly what they need. Marisela^A and Brittany^C used their local library's WiFi hotspot in their home. The family learned together as they searched for higher level family needs.

Marisela^A and Brittany^C revealed how they used technology to get to new places, the timing of their information search and fun aspects such as finding new adventures. Brittany^C noted the hardest thing to search for during the trip was finding somewhere to eat. She did not know exactly what her parents wanted. When looking, Brittany^C could only see the address and did not know where it was in relation to their current location. Marisela^A explained her frustrations with finding certain prices online for hotels and being unable to get the same rate in person. Marisela^A preferred to pay in cash because she was worried about online identity theft. This meant that they could not take advantage of special online-only deals. During V3, Brittany^C shared how she looked up hotels on *Trivago.com* (Plate 2) based on site familiarity from commercials. Once at the hotels, they compared prices in-person to online. Marisela^A knew this was a disadvantage, but she was not ready to explore online shopping. We interpret this interaction as a potential financial inequity outcome.

5.1.2 Case Analysis.

5.1.2.1 Individual resources and funds of knowledge. In Marisela^A's search process, she relied on her knowledge to interpret search results. She has connections with an immigrant community organization that provided her with social resources. Marisela^A has planning skills and was capable of organizing the vacation. However, Marisela^A and Brittany^C relied on each other's funds of knowledge to collaboratively solve their online information problems. Brittany^C is a fluent Spanish speaker and her older sisters have taught her about

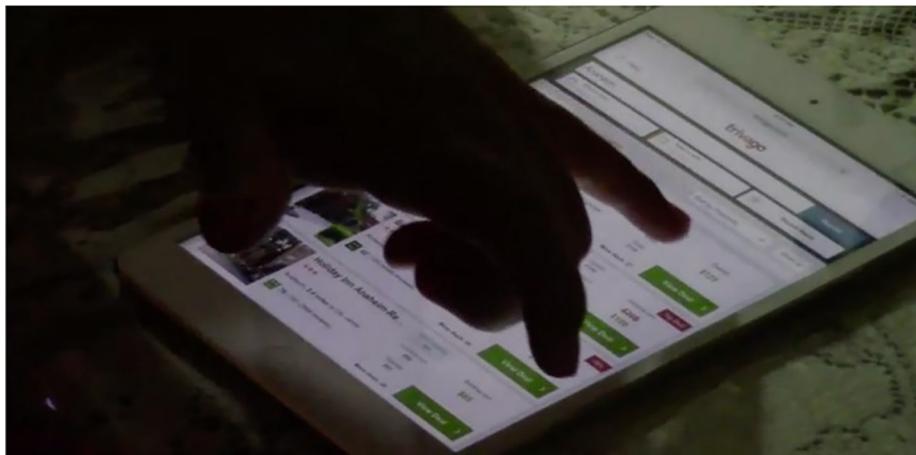


Plate 2.
Brittany^C searching
through *Trivago.com*

searching. Brittany^C has knowledge on identifying trustworthy web sources and relied on her education to search online.

5.1.2.2 Ecological challenges and support. Because the family only used cash, they did not develop skills for online financial systems. This lack of trust in online financial infrastructures made vacation planning difficult. The family had slower broadband and limited cellular service. During their vacation, the family did not have internet service on their iPad. Through Marisela's connections with the immigrant community group, the family borrowed a library Internet hotspot. Marisela^A relied on free internet at the community organization, Starbucks and libraries. While online, Brittany^C took screenshots of maps on her iPad because she recognized the need to reference maps later in non-connected areas. In this mundane yet nuanced task, we observed Brittany^C drawing on her funds of knowledge and identifying workarounds to information search challenges. We note the influence advertisements had on Brittany^C's knowledge about hotels, influencing which websites she trusted for online search results.

5.1.2.3 Resilience. The family chose to go across the country with limited English, unstable cellular data and anxiety over financial infrastructures. Resilience was demonstrated as the family leveraged how to use their community resources to find reliable Internet, cleverly used screenshots of maps for offline usage and determined the best locations to use cash. As the family searched, they found misspelling and poor access to WiFi hindered their success. Even when faced with these challenges, the dyad persevered to keep searching.

5.1.2.4 Collaboration. Despite vacations being a lower-priority search, the family navigated many workarounds together. We observed their family as making collaborative decisions about a lower-priority search, with a high-reward search result for their familial well-being. They relied on each other to learn about new locations and take a family vacation. When her daughters are not around, Marisela^A said she used a mobile translation app. These collaborative interactions to OSB occur not only among immediate family members, but within Marisela^A's social network. Marisela^A noted that before her daughter Brittany^C could access her computer, Marisela^A wanted to create a profile for Brittany^C. Neither Marisela^A nor Brittany^C could figure out how to personalize the computer. To overcome this challenge, Marisela^A asked her friend from the immigrant community group

to create a profile for Brittany^C. This instance highlights the reality of many Latino families who rely on one household device for multiple users, which may increase the collaborative nature of these technologies.

5.2 Case 2. Dulce^C and Elvia^A

5.2.1 Context of joint media engagement interaction. During the study, Elvia^A was a single mother of two daughters, Dulce^C (age 16) and Mari Cruz^A (age 21). Elvia^A mostly used her smartphone to communicate with her parents in Mexico through *WhatsApp* and used *Google Translate*. Dulce^C considered herself an advanced searcher and taught herself how to look for information on *Google* at age 7. She helped her mom with search tasks because her older sister is in college. During our V3 session, Elvia^A explained she needed Dulce^C to help her find information for a project. However, the project topic was unknown to both the researchers and her daughter. Dulce^C knew her mom used the laptop for sharing because smartphone screens are small. She tried to log into Elvia^A's email account but neither remembered the password. A collaborative interaction occurred as they referenced notes on Elvia^A's *iPhone*, but they were unsuccessful and needed to reset the password (Plate 3).

Next, Elvia^A asked Dulce^C to look for an email from her friend. Dulce^C found the email, but could not locate the specific information, which became visibly frustrating to both. Elvia^A commented, "She doesn't want to teach me well. My older daughter is the one that can teach me better." Dulce^C was trying to process the email, but it was written in Spanish. Later, Elvia^A showed Dulce^C printed project materials, "You have to try to find this, because this is the other one." Dulce^C started a new search using printed documents. Dulce^C typed [*wewonttwait*] into the search engine and clicked the "do you mean" suggested link. Dulce^C explained that the results were too general and started the search again. Dulce^C sighed, "I found it (the website)." Dulce^C explained that she usually finds information herself and then shows it to her mom, because it is faster that way. Elvia^A answered that this website was not what she was searching for; the website explained what [*wewonttwait*] is and "it's just pictures." Elvia^A showed her handwritten notes, explaining that she has read about this topic before on her *iPhone* (Plate 4).

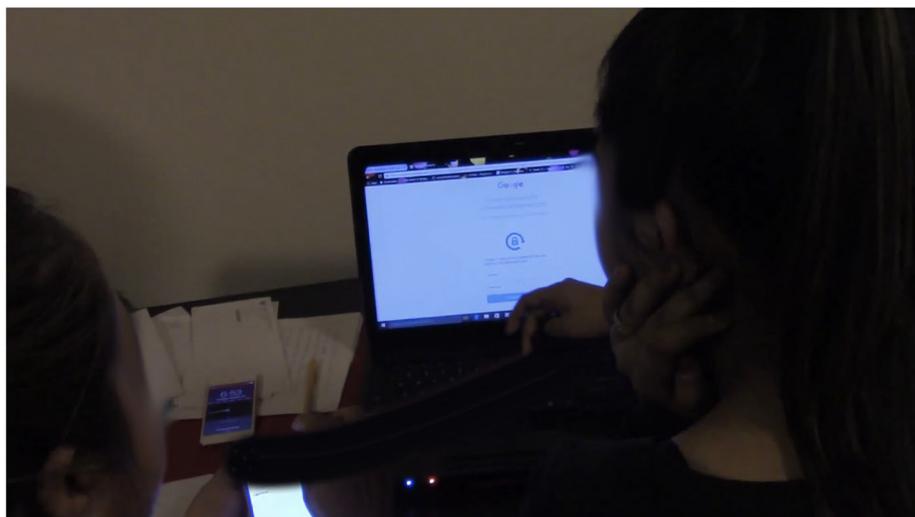


Plate 3.
Dulce^C (left) and her
mom Elvia^A (right)
try to reset Elvia's
email password

Youth invisible work

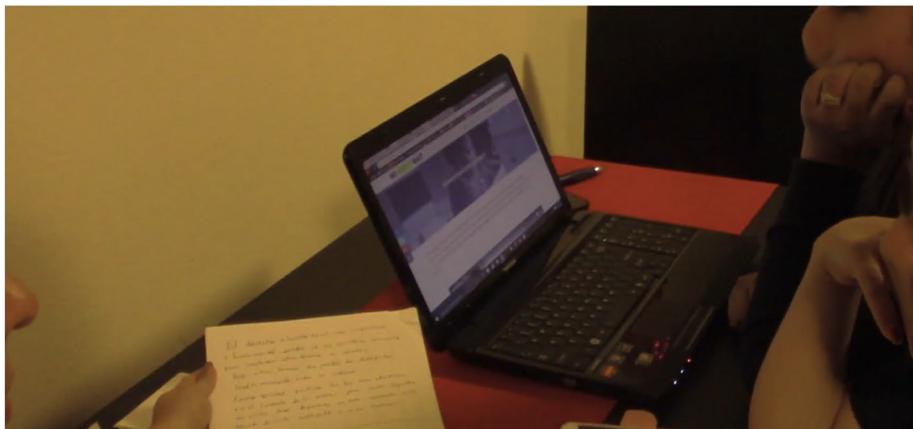


Plate 4.
Elvia^A (left) holds a
piece of paper while
Dulce^C (right) reads
the information
search results

Elvia^A suggested, “let’s put ourselves in *Google*, instead. No?” The paper has the word abortion. Dulce^C entered (definition of abortion) and responded, “Yeah, but it’s not what she is looking for.” Dulce^C seemed to know what her mom was looking for. Elvia^A explained that she had previously researched the topic, finding some information in Spanish; however, she wanted Dulce^C to help her find statistics and unbiased facts. Elvia^A then told us she was searching for information about abortion to prepare for a community leadership group talk.

Dulce^C typed in (definition of aborto) but was confused about what Elvia^A wanted to find. Dulce^C asked, “Are you looking up what the word abortion means? Or are you looking up what it means for other people? The definition of the word or what abortion means to women?” Elvia^A responded that she wanted a literal definition. Elvia^A read the screen and pointed as she read about two types of abortions, “This is interesting to me” (Plate 5).

5.2.2 Case Analysis.

5.2.2.1 Individual resources and funds of knowledge. Dulce^C has developed prior technology skills, such as knowing how to access email, how passwords are used, figuring

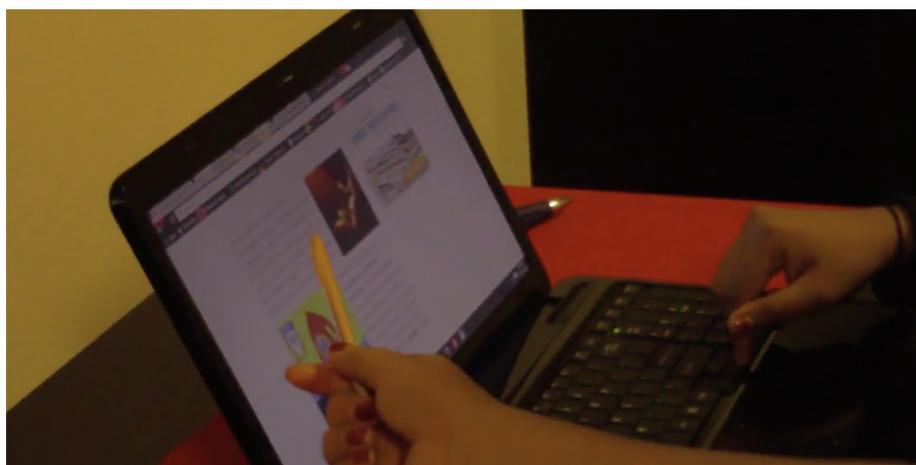


Plate 5.
Elvia^A pointed to the
information on the
screen with her pencil
(left) while Dulce^C
scrolled (right)

out search queries and the use and limitations of *Google Translate*. She has developed search regulation behaviors (Brand-Gruwel *et al.*, 2009) that allows her to ask her mother the right questions. From these answers, Dulce^C can input queries that are more efficient. Elvia^A has prior research skills but finds English difficult. She used paper documentation that was not part of the technology to research what to search for.

5.2.2.2 Ecological support and challenges. Dulce^C can navigate email systems, but the technological design made passwords difficult to use. This design feature made it hard for them to log in to search. Similarly, *Google Translate* does not translate between English-to-Spanish perfectly. Elvia^A had difficulties learning English from her support network. She noted that while she took literacy classes, the instruction did not help her because of language difficulties. Like Family 1, Elvia^A shared a mistrust of online purchasing. Dulce^C explained that she was not afraid of online shopping because she constantly monitors her bank account.

5.2.2.3 Resilience. The family faced limited availability for help, as the oldest daughter worked and did not always have time. The family relied on each other for well-being, for financial support and for information searches. For Dulce^C, there is an emotional and familial responsibility. She noted, “I’m annoyed, but I can’t leave the task” when searching with family. Elvia^A has limited self-efficacy; she knew her limits with the technology. Because of these frustrations and the frequency that they search for information, they both indicated occasional miscommunications. Dulce^C explained that it took too long to get information because Elvia^A was not direct, “First she told me to go to her email, she should have just told me what she was trying to find instead of me looking through all those things.” Elvia^A explained that when she asked Dulce^C for help, Dulce^C did not have patience with her because she processes information more slowly. We asked Dulce^C, “how do you know what you find you can trust?” Dulce^C explained, “I don’t just go to one website. I go to others, and I try to combine what other websites are telling her.” The family struggled as they tried to solve the abortion information problem highlighted above. Yet the family persevered; throughout their JME process, they became more resourceful.

5.2.2.4 Collaboration. Online searching can be bidirectional (Pina *et al.*, 2018); both mom and daughter relied on each other. Elvia^A brought all the printed papers from the project with her. The technology influenced how mom and daughter worked together. The family needed to learn to store and retrieve passwords. They had to check *Google Translate* together for accuracy. Dulce^C could not do the search alone. She had to pause, regulate and ask her mother questions (“Are you looking for a literal definition?”). Together, they leveraged their funds of knowledge, worked through technology and communication challenges and collaboratively solved information problems without giving up.

5.3 Case 3. Mateo^C and Carmelo^A

5.3.1 Context of joint media engagement interaction. Mateo^C is Carmelo^A’s (age 12) youngest grandson who helps with his searches. Mateo^C is a visual and audio searcher (Foss *et al.*, 2013). Mateo^C struggles with spelling and prefers to speak into the smartphone. Carmelo^A owned a restaurant and wanted to learn more about technology. He has searched online for items for his restaurant and prefers images to make sense of information.

In V2, we observed Carmelo^A and Mateo^C searching together for new industrial stove knobs from *Amazon.com*. Mateo^C clicked on the *Amazon* app, then clicked on the search bar (Plate 6). Mateo^C then showed Carmelo^A how to use the search bar. Carmelo took the smartphone and typed [*buttons for*] in Spanish. Mateo^C interrupted, asking if this was for clothing because of the “buttons,” but Carmelo^A explained that this was for stoves (*el botón*).

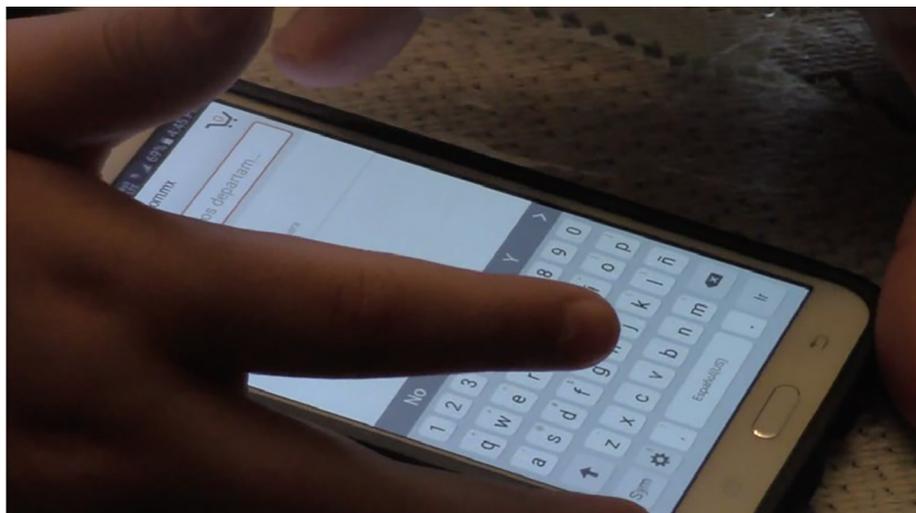


Plate 6.
Mateo^C setting up the
search for Carmelo^A

When Carmelo^A finished typing, the app did not return images of what Carmelo^A was looking for.

There was a visible disconnect in what the dyad was searching for. Mateo^C took the phone back and typed the word [buetten] into the search bar. Mateo^C told Carmelo that the search was not giving him what he wanted. Carmelo^A took back the smartphone, exited the *Amazon* app, clicked the *Google* app and typed in Spanish (how do you spell buttons in English). *Google* returned Spanish-to-English translation results for the word buttons. Carmelo^A said, “There it is! This is how I do it. But it takes me a long time.” Carmelo^A pointed out he had seen Mateo^C use voice for searching and asked Mateo^C to teach him about this. Mateo^C clicked on the voice icon on *Google* search (Plate 7) and showed Carmelo^A how to use voice for search.

Carmelo^A said to the smartphone, “I want to look for buttons for the stove,” but the search did not work. Mateo^C explained to Carmelo^A, “You have to push this button and then go. You push it and go.” Carmelo^A used the voice assistant again, saying “I want to look for buttons for the stove.” Carmelo^A looked at search result images of the knobs he was looking for, having learned a new technological skill – how to search *Google* in Spanish using voice (Plate 8).

During V3, Carmelo^A wanted to use the iPad to search how to make tortas ahogadas (a type of sandwich from Jalisco, Mexico), as he saw restaurant customer demand for it. Mateo^C explained that he was helping his grandfather find ingredients in Spanish, but he struggled with pronunciations. When Carmelo^A found a recipe he liked, he clicked on the link because he liked the images. Carmelo^A then asked Mateo^C to go back and translate the recipes.

Interestingly, there was a difference in how they each found the recipe ingredients. Carmelo^A used image results, but Mateo^C found the recipe from *Google* search results. The method of searching for a recipe demonstrated that they each have different systems for searching and have performed this visual/text search collaboration before. Their search was conducted in Spanish, but Carmelo^A noted, “There is the problem – Mateo^C struggles with Spanish.” Despite difficulties, Carmelo^A noted “[Mateo^C] prepares it (the search) for me” and then Carmelo^A can type what he needs. Mateo^C has enough Spanish understanding to

Plate 7.
Mateo^C teaching his
grandfather
Carmelo^A how to
search for
information using
voice

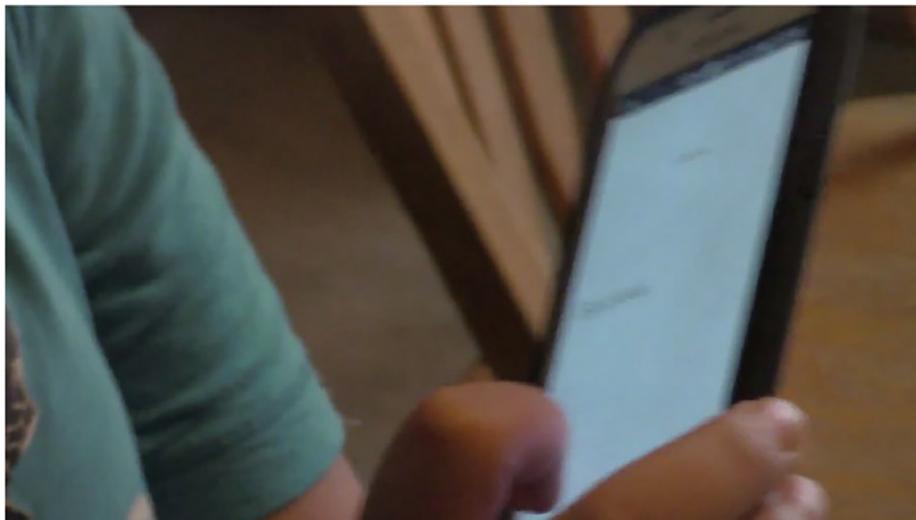
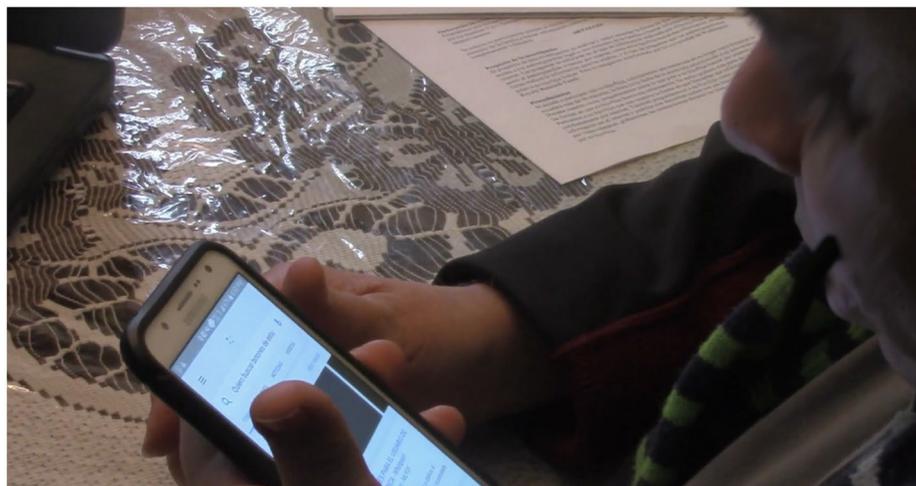


Plate 8.
Carmelo^A reading the
search results for
stove knobs



support his grandfather's needs. Mateo^C said that when he reaches high school, he'll be able to take Spanish classes. Like other families, Carmelo^A worked closely with Mateo^C's older brother until he was no longer available. We concluded the search tasks by asking how hard it was to search for information online. Carmelo^A highlighted their situation:

You lose time when you are searching for things. The only solution is to study. To learn ourselves. Because time passes and there are stages. First their mom would help me, then her older son, *then the middle child, he [points to Mateo^C] is the last one. Now who am I going to ask?* ("Se pierde tiempo en búsquedas. La única solución es estudiar. Ponerse uno mismo las pilas. Porque van pasando las etapas. Primero me ayudaba su mamá, me ayuda el que sigue, luego el que sigue, y el [points to Mateo^C] es el último. A quien le voy a preguntar ahora.")

5.3.2 Case Analysis.

5.3.2.1 Funds of knowledge. Carmelo^A relied on his experiences running the restaurant to explain to Mateo^C what he was looking for. Mateo^C set the search up for Carmelo^A by:

- previously configuring *Amazon* app settings to Spanish;
- showing him where to enter his search terms; and
- clarifying what they are looking for to ensure the translation was correct.

Funds of knowledge are tapped as the dyad explores alternative search strategies moving from *Amazon* app to *Google* search, to voice assistant. Carmelo^A observed Mateo^C using *Google* voice assistant and learned how to do it himself through Mateo^C's scaffolds. The two helped each other conceptualize the problem, explore different internet resources to navigate challenges and learn new language and technology skills. We see knowledge of alternative strategy exploration being taken up by Carmelo^A and Mateo^C as they expand their knowledge of technology to uncover the shared meaning of knobs/buttons in their multisensory (auditory, visual), intergenerational, bilingual and OSB practices.

5.3.2.2 Ecological support and challenges. While Mateo^C can speak Spanish, spelling and vocabulary are difficult for him. His middle school does not offer Spanish. Carmelo tried to use Spanish to search. However, while designers have created new voice interfaces, the smartphone did not recognize Carmelo^A's accent. These obstacles require frequent exchange of devices between the two. Another common issue was online password usage and retrieval. Finally, this family has a strong relationship between grandfather and grandchild, especially as Carmelo^A lives with them. However, as the family is growing up, Carmelo^A wondered where his future online search support will come from.

5.3.2.3 Resilience. Mateo^C and Carmelo^A cover a wide range of online searching together, such as banking and health insurance. These topics range from low to high priority and are sometimes difficult to navigate. Mateo^C did not complain during our visits. He was aware his Spanish language skills were limited but worked through the search tasks with his grandfather. Carmelo^A and Mateo^C depended on each other for important search needs, potentially strengthening their familial relationship and supporting intergenerational learning in the process.

5.3.2.4 Collaboration. We noted that search collaborations here are bidirectional (Pina *et al.*, 2018). Carmelo^A does not have Mateo^C search and retrieve the results for him in a unidirectional manner. Instead, both relied on each other's knowledge to collaborate. Mateo^C started the search and passed the device back to Carmelo^A for checking and regulation (Brand-Gruwel *et al.*, 2009). Mateo^C understood the technology and its affordances for search, and he spoke English fluently. Carmelo^A is fluent in Spanish and has some searching skills. Both support each other's knowledge through this engagement and walk away with new skills as they address everyday information problems together.

6. Discussion

6.1 Theoretical model of joint media engagement for family work

We developed a conceptual model that envisions how JME takes place in family work (Figure 1). Prior literature focuses on search literacy of individual searchers (Brand-Gruwel *et al.*, 2009). Our theoretical framework argues for an extension of search literacy through collaborative family information searching. It also includes how families use ecological support systems, yet they are also stifled by persistent ecological challenges. This focus also acknowledges that families must develop resilience (Patterson, 2002) to sustain their information search.

6.1.1 Ecological support and persistent challenges. Collaborative engagement for solving family information problems through JME does not exist in a vacuum. To understand families and their JME interactions for family work, we need to investigate how microsystems, macrosystems and exosystems both support and challenge families (Bronfenbrenner, 1977; Gee et al., 2017). Families noted important support systems for their information searching, such as extended family members (microsystem), neighborhood community centers, schools and libraries (mesosystems), affordable broadband and technological infrastructures (exosystems) (Katz and Gonzalez, 2016). Countering these supports are persistent challenges and struggles such as emotionally charged conversations in families (microsystem), underfunded neighborhood literacy programs (exosystems), technology designs and infrastructure that are not conducive to information searching (exosystems) and access to cultural capital and familism (macrosystems) (Katz and Gonzalez, 2016; Pina et al., 2018).

6.1.2 Family resilience development through funds of knowledge and collaborative problem solving. As these ecological challenges persist, family resilience for information seeking must develop (Patterson, 2002). As a process, families are resilient at certain times. In our case analysis, we demonstrate that family resilience is a process influenced by two aspects of collaboration. First, each individual family member has their own funds of knowledge (Moll et al., 1992; Roldan et al., 2019) including skills, experiences, assets, knowledge and cultural strategies that parents and children use to navigate complex information problem solving tasks.

Yet, individual funds of knowledge about searching (Brand-Gruwel et al., 2009) are not enough to develop family resiliency. Collaborative information problem solving skills and experiences are important. Resilience is needed to work together, despite differences and barriers. Families must negotiate their literacy, emotions, affect, stress and other factors for collaborative search (Morris, 2013). In our case studies, we demonstrated families are in constant negotiation between adult family members individual knowledge and collaborative problem solving. (Pina et al., 2018). JME for family work is the outcome (Takeuchi and Stevens, 2011).

6.1.3 Productive joint media engagement around family work and responsibility. Not all study families were able to solve every complex information problem. Takeuchi and Stevens (2011) identify six conditions that foster productive JME, that is, the collaborations, conversations, processes and development that occur to support family engagement around

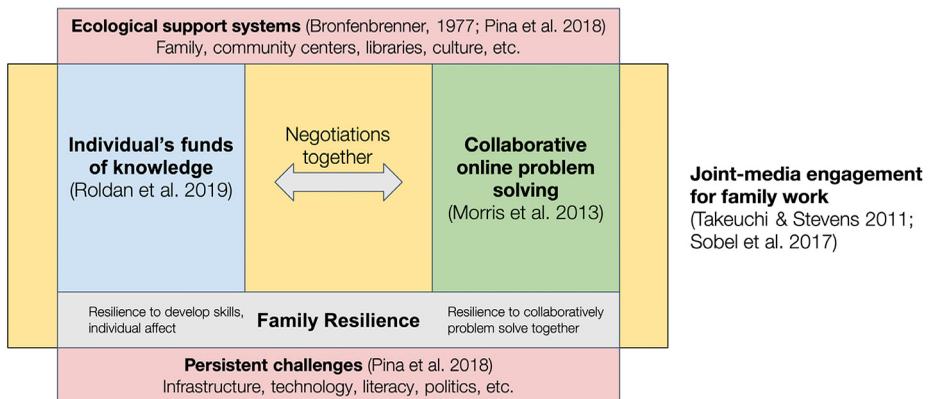


Figure 1. Conceptual model of online search and brokering collaborations

technology. A theoretical lens that considers ecological systems, family resilience, funds of knowledge and collaboration, can help to unpack and interpret productive JME during family work (Sobel *et al.*, 2017). Our findings ask six questions to determine productive collaborations around OSB:

- Q1. Mutual engagement: How do families work together by knowing each other's skills and experiences?
- Q2. Dialogic inquiry: How do families communicate together to work when they need each other?
- Q3. Co-creation: How do families develop shared understanding in work to solve an information problem?
- Q4. Boundary crossing: How do family roles shift and change during processes of this invisible work?
- Q5. Intention to develop: How do families grow and develop during work? What learning continues to occur?
- Q6. Content, not control: How does design and technical infrastructure support, rather than distract, families' interactions with digital information?

Technology usage was not solely dependent upon broadband reliability. The design of ICTs contributed to and hindered how information searches occurred. New apps (e.g. *Google Translate*) allowed for more searching across different ubiquitous and mobile technologies, facilitating families coming together as a collaborative unit to solve information problems. However, design solutions had frustrating elements (e.g. overwhelming search results, inaccessibility of PDF files on mobile devices, poor user-interface) that stifled OSB.

6.2 Implications

Our model suggests educators and designers have a responsibility to consider family information searching and youth invisible work through an ecological lens.

6.2.1 Learning and education in communities. We have demonstrated in this article that learning and engaging in family online searching is not only vital to the development of individual and digital literacy skills (Brand-Gruwel *et al.*, 2009), it is a part of family learning. While community services, libraries and schools have a responsibility to support individual digital and information literacy development, our model highlights the need to recognize funds of knowledge, family resiliency and asset-based learning. Schools and teachers should identify and harness youth invisible work as a form of learning at home. We believe educators can do this by highlighting the importance of information problem solving in homes and youth in their families. Libraries and community centers also play a critical role in supporting parents and adults for technical assistance (e.g. WiFi access) and information resources.

6.2.2 Technology design. Designers need to recognize that children and youth are using the same tools as adults to seek high-level critical information. Our model suggests that if parents and children are negotiating information seeking with the same technology tools but different funds of knowledge, experience levels and skills, the presentation of information (e.g. online search results, information visualizations) needs to accommodate different levels of understanding. We recommend designers work closely with marginalized communities through participatory design methods (Yip *et al.*, 2017) to better understand how interfaces and visuals can help accommodate youth invisible work.

7. Limitations and conclusion

An intergenerational OSB process is different from collaborative online information problem-solving that happens between classroom peers or co-workers. Our research shows how both parents and children draw on their funds of knowledge, resilience and ecological support systems when they search collaboratively, with and for their family members, to problem solve. This is a case study of three families working in collaboration with each other. This case study informs analytical generalizations and theory-building rather than statistical generalizations about families (Yin, 2011).

In conclusion, the learning media and technology community can benefit from an understanding of how OSB is a form of collaborative learning around technologies, given that it is the daily reality for millions of bilingual children. First, we argue that there could be further studies looking at the possibility of OSB and family collaborations as gendered dynamics. We know that family work has a gendered component (Coltrane, 2000), and there is a possibility that similar patterns around gender and digital searching could be found in other families (e.g. the connection in mother-daughter relationships). We also believe there is a need for a deeper understanding of OSB, particularly as new technologies (e.g. artificial intelligence, digital games, voice assistants) are on the horizon, shaping the ways that families make critical decisions together. Finally, for future studies, we encourage exploration of our model beyond immigrant family populations. Health searching and brokering is a phenomenon that exists in lower-SES families that depend on their children as health seekers (Zhao, 2009). Specifically, COVID-19 has shown that family work around health information search has extended to nonimmigrant population, in which children act as online searchers for their families (Drouin *et al.*, 2020). As the geriatric population grows, senior citizens are also asking their adult children to act as online health search and brokers (Lund and Maurya, 2021). Therefore, we believe our model for OSB has utility for many kinds of online searching as family work.

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