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# Design Guidelines for Parent-School Technologies to Support the Ecology of Parental Engagement

**Marisol Wong-Villacres** *
Georgia Institute of Technology
Atlanta, USA
lvillacr@gatech.edu

Escuela Superior Politecnica del Litoral
Guayaquil, Ecuador
lvillacr@espol.edu.ec

**Upol Ehsan** *
Georgia Institute of Technology
Atlanta, USA
ehsanu@gatech.edu

**Amber Solomon**
Georgia Institute of Technology
Atlanta, USA
asolomon30@gatech.edu

**Mercedes Pozo Buil**
Georgia Institute of Technology
Atlanta, USA
mercedes.pozo@eas.gatech.edu

**Betsy DiSalvo**
Georgia Institute of Technology
Atlanta, USA
bdisalvo@cc.gatech.edu

## ABSTRACT
Parents' engagement in their children's education is key to children's academic success and social development. For many parents in the U.S., engagement is still a struggle partly due to a lack of communication and community-building tools that support the broader ecology of parenting, or parental ecology. Although current technologies have the potential to create opportunities to improve parental engagement, little is known about the impact of existing technology's design on the parental ecology. We present findings from 63 interviews with parents and an observation of existing technologies that support parent-school interactions. We found four critical issues that the design of current technologies need to address: (1) inflexibility in the boundaries of digital spaces, (2) inequality, (3) fragmentation and inconsistency of information, and (4) lack of relevant non-academic information. As a result, we propose design guidelines for technologies to support the parental ecology, and reflect on design issues that require further research.

### ACM Classification Keywords
H.5.3 Group and Organization Interfaces: Computer-supported cooperative work

### Author Keywords
Social Network; Parental Engagement; Schools and Teachers; Community Building; Meaningful Interactions

*Both authors equally contributed to this work



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## INTRODUCTION
Parental engagement in their children's education is key to the academic success and social development of their children [3, 6, 16]. However, for many parents in the United States, this engagement is challenging [26, 23, 15] in part because of a lack of communication and community-building tools that support the broader ecology of parenting [24, 11]. We refer to the broader ecology of parenting, or parental ecology, as the many influences on how one acts as a parent [7, 1, 5]. Our focus is to understand how digital technologies can support the parental ecology so as to augment opportunities for children to reach educational outcomes.

Schools have traditionally provided some digital communication tools, but these tools have been limited to supporting official interactions with parents, such as electronic grade reports, digital newsletters, and websites or parent portals where teachers post information [15, 8, 19]. This traditional communication tends to disenfranchise parents' ability to act outside school-created channels of communication. In addition, it ignores the engagement that happens between parents or others in the community (e.g., other parents or their children's former teachers) [15, 21]. Previous research suggests that parents have been leveraging other information technology tools to connect and interact in meaningful ways with other individuals in the parenting ecology [9]. These tools enable parents to create and maintain spaces in their parenting ecology, where they can communicate with other parents. However, we argue that these tools do not provide every parent the same opportunity to contribute their voice equitably and influence the ecology.

Regardless, technology can be a way to support more accessible, meaningful, and equitable communication to improve parental engagement. It can also open new channels of communication with schools, teachers, and other parents [13, 25]. However, there have been few studies exploring how parent-school communication technologies support community engagement [14] and how should be designed to support the parental ecology [29, 28].

To address these issues, we expand existing work on parents and technology by studying technologies' ability to facilitate meaningful interactions in the parental ecology. Based on the work of Hughes et al. [17], we define *meaningful interactions* as the communicative activities in which all parties can express their experiences and interests, and make sense of others' expressions in terms of their own particular purposes and agendas. To better understand the structures and resources that support the interactions amongst members of the ecology, we use the concept of *space* described by Barton et al. [1]. They define a *space* as a setting in which people come together to pursuit desirable outcomes. Looking at the digital and non-digital spaces of the parenting ecology allows us to identify social norms for participating in those spaces, the tools they use to support the shared participation, and the types of interactions the spaces support.

In this paper, we present the findings from 63 interviews with parents as well as observations of parents and schools/teachers interactions in existing digital spaces. This study focuses on parents as a response to parents' lack of voice in the existing communications technologies hosted by schools. We recognize that teachers and schools may have different needs and agendas for communications and are important actors in the parenting ecology. However, our findings and previous research suggest that existing technologies do not support meaningful interactions amongst individuals of the parenting ecology. Instead, these technologies tend to reinforce power and equity issues between schools and parents, as well as amongst parents.

We contribute in three ways to the growing body of research on the design of parent-school communication technologies. First, we examine existing parent-school communication technologies beyond the operational issues of their integration in schools and homes. We provide a rich description of the issues and opportunities of improvement in these technologies in terms of parental engagement within the parenting ecology. Second, drawing from our findings and inspired by previous work on parents, technology, and education [9, 2], we derive design guidelines for digital interaction spaces that support parents' engagement with their children's education. Third, we identify a research agenda for the creation of such digital interaction spaces.

We begin this paper by reviewing previous research on the notion of parental engagement and the impact of technology in parent-school relationships. Next, we describe the methods and findings from our study, focusing on the role of technologies in supporting spaces of interaction within a parenting ecology. Finally, we conclude by proposing design guidelines for interaction spaces and reflect on design issues that require further research such as privacy and community management.

## RELATED WORK

In this section we provide a rationale for focusing on parental *engagement* instead of the traditional concept of parental *involvement*. We then explain the relevance of meaningful interactions for the parenting ecology. Finally, we establish differences between our work and previous work on technology and parental engagement.

### From Parental Involvement to Parental Engagement

Educational research has traditionally used the term *parental involvement* to define activities and ways for parents to interact with the school environment [16, 12, 3]. These activities are determined to be extremely relevant to the growth and development of children [27, 16, 12]. However, the term parental involvement does not adequately portray the dynamic nature of parents' participation in schools [1, 7]. Thus, in our study we chose to use the term *engagement* as defined by Barton et al.'s [1]. They conceptualize parental *engagement* as the dynamic, distributed, and interactive process that parents go through to navigate barriers between home and school. They propose parental engagement as a relational phenomenon among parents, teachers, and communities framed by the spaces in which the engagement happens. Such spaces are the underlying structures and resources where parents can engage in meaningful exchanges to establish their presence at school and influence it in nontraditional and informal ways.

Exploring technology-mediated parent-school interactions through the lens of engagement enables us to move beyond describing how parents use or complain about technologies imposed by schools. Furthermore, it allows us to identify gaps and opportunities in existing technologies to foster the creation of spaces where parents can interact in the parental ecology.

### Meaningful Interactions

Interactions amongst parents and schools is an issue of concern for educational researchers. Parent-school interactions entail mostly the delivery of school-directed information (e.g., parent-teacher conferences where teachers inform parents about their child's progress and activities, an email with a newsletter, etc.) [11]. However, these restricted types of exchanges tend to hinder parental agency to impact the school environment [15, 21, 17]. Teachers tend to interact with parents as if they are visitors [20]. Thus, feeling unwelcomed, parents tend to perceive that their interests and ideas for improvement are not considered valuable.

For these reasons, many researchers have argued that parent-school interactions need to go beyond the exchange of depersonalized information, and instead, focus on building real connections between all individuals of the parenting ecology and be meaningful for all parties [15, 2, 17, 14]. These interactions need to be meaningful for all parties [17, 14]. *Meaningful interactions* enable all parties to represent their practices (e.g., home practices, school practices, teacher's and parents' practices) and interests to impact the schooling environment. Moreover, meaningful interactions allow participants to interpret others' shared information in terms of their own particular purposes and agendas. To better understand technology's role in the parent-school relationship, we analyze parent-school physical and digital interactions through the lens of meaningful interactions.

### Parental Engagement and Technology Use

Research on the role of technology in parental engagement has mostly focused on assessing parents' and teachers' perceptions of how useful technologies are. For example, previous work has established that parents perceive parent portals and

electronic progress to be useful for being more aware of their children's academic performance [10, 8]. Nelms [22] found that many parents appreciate email-based communication and feel that technology allows them to ask questions and voice concerns. Grujanac [15] demonstrated that schools and teachers tend to resist operational procedures introduced by new technology due to lack of adequate training or support to integrate these practices into their routines .

Unlike existing research, our study focuses on identifying and studying the spaces for parental engagement that existing technologies are fostering. Our approach attempts to inform the design of new technologies that foster equitable partnerships between schools and parents.

### Parental Engagement and Technology Design

In regards to HCI-related research, parents in children's education are an emergent audience. Research on the topic has proposed the use of existing/new technologies such as videotapes [17], online forums [2], social networking sites [29], and learning suites [28] to help parents, teachers, and children participate in school-based activities. However, no previous studies have focused on the design of parent-school technologies to support parental engagement from a community-based, ecological perspective.

Although prior research has provided some design implications, it has not focused on supporting the parental ecology. For example, work on parents' practices when seeking educational information for their children [9, 18] suggested parent-school communication technology should allow both parents and teachers to have an impact at school, consider parents' reading and writing levels, and facilitate parent-led initiatives rather than school-authored ones as the only way of communication.

We extend HCI-related research on technology design for parental engagement by providing detailed design guidelines for a digital interaction space that supports equitable voices in the parental ecology. Our goal is to harness technology's potential to strengthen social systems related to parenting and education.

## METHODS

To understand the impact of existing parent-school technology's design aspects on the parental ecology, we analyzed interviews with parents on the technology they use to communicate with schools and stay informed on their child's progress and observed parents using existing parent-school related technologies.

### Parent Interviews

We analyzed 63 semi-structured interviews conducted with parents in the U.S. to understand the types of parent-school interactions that communication technologies currently support. These interviews were from a larger study about parents' strategies for finding learning opportunities for their children [9].

Interviews included questions on the relationship between parents and teachers and the technologies they use to communicate. Participants were from three different audiences: 28 parents were from a low socioeconomic status (SES) from a southern U.S. urban area, 15 parents were from a high-SES in small towns and rural areas in the Midwest of the U.S., and 20 parents were from a high SES in suburban and urban areas across the U.S., mainly concentrated in the southeast. The age of participants' children varied from one to eighteen years old.

### Technology Observations

In addition to the 63 interviews, we reached out to 9 parents and 2 teachers from various backgrounds to understand technology's role in supporting parents' creation of online communication spaces. We asked these informants to direct us to the current technologies parents and schools use to interact with each other (e.g., Class Dojo, email, Facebook pages/groups, etc.). We observed one informant using technologies that require private access such as school email, Class Dojo, and closed groups of parents on Facebook. We also interacted with publicly available technologies (school Facebook pages, schools' websites, and teachers' blogs). We took detailed notes of the content managed in these tools, as well as on the existing online interactions taking place.

### Data Analysis

Interviews were transcribed, and participants' names were anonymized and replaced with pseudonyms. Using the transcripts and the notes taken during our observations of the technologies, we conducted an inductive approach to data analysis, grounded in coding techniques. We generated a set of codes that described patterns related to technology support for spaces of interaction and meaningful interactions. Then, an iterative analytic process allowed us to generate themes that were reduced over time and that led to the findings we present in this paper.

## FINDINGS

We organize our findings based on the concept of *spaces* within the parenting ecology. This focus on spaces allowed us to identify the underlying structures and resources available for parents to engage in meaningful interactions and establish their presence in schools. In this section, we first define the spaces we identified from our investigations. Then, we provide a review of existing parent-school technologies in terms of their role in parents' creation and maintenance of interaction spaces. Last, we describe the issues and opportunities existing technologies entail for supporting the parental ecology.

### Interaction Spaces

Based on our findings, we extend Barton et al.'s work [1] and propose a new categorization of spaces based on the ownership of the space. We identify two types of spaces where parents can interact in meaningful ways: *formal* and *informal*. *Formal spaces* are owned by a school or a school endorsed organization, like the Parent Teacher Association (PTA). *Informal spaces* are owned by parents, e.g., parents informal meetings with teachers when they are picking up their children from school, and parent groups on Facebook.

Our findings also show that spaces can be characterized by interactions both in the physical and digital world. Sometimes digital interactions help maintain spaces in the physical-world.

For example, the exchange of text messages and emails between parents and teachers informs parent-teacher informal conversations during pick-up time. Other times, spaces are created and maintained by almost-only digital interactions. This is the case of school's Facebook pages and websites.

#### *Formal Spaces*

Both interviews and our observations of digital environments show that most parent-school interactions in formal spaces (e.g., the classroom, science nights, and school's Facebook page) involve the exchange of school-directed information only. These findings are in line with previous work, which found schools often define the terms of home-school relationship [17, 14].

When meaningful interactions occur in formal spaces, it is often the result of two communication mechanisms. The first mechanism is actualized by parents' efforts to connect with a member of the school (e.g., a teacher) and to construct a close relationship with that member. For that purpose, parents and teachers use mostly face-to-face interactions supported by personal communication technologies, such as SMS, email, and cellphone calls. Most parents explained this constant communication allows them to have more agency in the communication.

The second mechanism entails school's and teachers' efforts to suggest information (e.g., about extra curricular activities) instead of imposing it (e.g., progress reports or calls for mandatory school events). In our interviews, parents mentioned they utilized these opportunities to help their children explore new learning experiences according to both their, and their children's purpose.

#### *Informal Spaces*

Informal spaces are spaces created by parents inside or outside formal spaces. Many parents shared their stories of creating informal spaces within the school by consistently interacting with teachers or other school actors. In addition, many parents attempt to participate in spaces for meaningful interactions with other parents and teachers outside the school (e.g., cell phone conversations, WhatsApp and Facebook groups). In these spaces, parental voices can flourish– parents can express themselves without potential judgment from teachers or school-based moderators. Parents with access to such spaces are more empowered to make decisions about their child's academic life. For example, Carolina shared how she harnesses these informal spaces to support her daughter's academic success.

> *"Then when she [Mia, Carolina's daughter] adds the AP classes into it, it will be interesting to see how that all kind of plays out. A lot of my friends at church have kids that have already gone through high school, or not gone all the way through but have kids higher than what Mia is. I call them up and say, 'OK. Now what do we do?' Or even just asking about teachers. I mean your child is going to have that teacher but sometimes it's nice to know: Is it a hard teacher? What are the quirks of this teacher? So that you can kind of prepare her to kind of work around."* [Carolina, mother of a high-schooler]

Many parents also described how they capitalize their use of social media, such as Facebook and WhatsApp, to participate in parent-to-parent informal spaces. For example, Renata told us how she used Facebook as an informal space to gain perspectives from other parents' opinions.

> *" I would go on Facebook and post something and see what my friends who have kids the same age might recommend. Yeah. If there's something ...say, 'Hey. My kid needs extra help in history. What do you know that's out there' then I might type something and then with how Facebook works in 30 minutes you've got 10 different ideas come in at you."* [Renata, mother of a middle-schooler]

Parents' accounts on their participation in informal spaces for parent-to-parent interactions strongly suggest these spaces are key for a successful engagement. Next, we describe the current parent-school communication technologies in terms of their role in the creation and maintenance of formal and informal spaces of interaction.

### Technologies and Interaction Spaces

In this section, we describe the technologies parent and schools are using to communicate. We have grouped these technologies in the following categories: technologies for classroom management, technologies for community-building, and technologies for personal communications. In contrast to previous work on technology and parental engagement, our descriptions of these technologies focus on the support they provide to the creation of interaction spaces.

#### *Technology for Classroom Management*

Classroom management technologies allow schools to create digital *formal spaces*. Schools use these technologies to inform parents on their child's academic progress or behavior. For example, Class Dojo is a cross-platform application for community-building where teachers post photos or videos of moments in the classroom to help parents stay informed on what their child did in class. Parents can also instant message teachers, but not to other parents. Other technologies for classroom management include customized versions of "parent portals" offered by various school districts and schools . These are web-based applications where teachers can post students' grades for parents to see and send messages to parents. Although these technologies allow for parents to communicate with individual teachers, most interviewed parents indicated they would rather use personal technologies such as email and SMS to support their interactions with teachers.

#### *Technology for Community Building*

Both interviews and technology observations demonstrated schools and school-related organizations use social media sites to create *formal spaces*. Likewise, these technologies are being used by parents to create *informal spaces* where they can interact with other parents and teachers.

From our observation of school-related digital technology we learned that schools use their Facebook pages as formal spaces for broadcasting school-related information (e.g., events or

general weather advice to parents). On Facebook pages, parents can post, but the school ultimately decides what content stays. Organizations associated with the school, like the PTA, often create their own Facebook groups. Schools also use Twitter to communicate with parents on more urgent matters, like a late bus arrival. In addition, many schools ask their teachers to post all classroom related information on school-hosted blogs.

Our interviews, as well as our observations showed how many parents use social tools to self-organize into *informal* communities with other parents and teachers. Miranda, for example, shared how useful a "Mom's Google group" was to her.

> *"A lot of the moms in the class, we're on a Google Group, so we'll all email each other when there's different events coming up, or when there's an educational thing that we want to bring to the school."* [Miranda, mother of a pre-schooler]

We observed that in these spaces parents can share information that represents their interests and experiences, like questions on child-rearing, or children-related social events outside of the school.

#### *Technology for Personal Communication*

As a whole, the data we collected highlighted that parents and schools use technologies such as emails, text messages, and phone calls to foster different types of spaces. These technologies support parents' efforts to create *informal spaces* within the schooling environment. On the other hand, schools use such technologies to extend their *formal spaces* outside the school boundaries.

Many parents we interviewed frequently strove to construct strong relationships with school actors, which include teachers and administration staff. These relationships allowed them to create informal spaces of interaction that afford a two-way communication in which parents felt they could influence life in schools. To foster these spaces parents still preferred using opportunities for face-to-face interaction such as stopping by the school, visiting the class, showing up to conferences, and even volunteering to help in class. However, our interviews highlight that communication through personal technologies such as email, text messages, and phone calls are key in helping parents pave the way for creating and maintaining those informal spaces. Tamara, explains how she depends on these technologies to develop a sense of closeness with her daughters' teachers.

> *"All of her teachers, I develop close relationships with them. I even have their cell phone numbers. We email sometimes. I might just stop up to the school to visit the class or check in on her. But a lot of times if I can't get them at the school I always try email first. But I ask them if they don't mind me having their cell phone number, and most of them never mind. So, yeah. I have a lot of access to her teachers."* [Tamara, mother of a middle-schooler]

In addition, parents, such as Pablo and his wife, use these technologies to activate informal spaces of interaction with other parents.

> *"What will happen generally is we don't email her friends' parents a lot, but let's say we hear something from our daughter about a camp that one of her friends went through, we may either wait until we see that parent and talk to them about it or we send them an email. So technology does facilitate that and like I said, I bet my wife emails and stuff more than I know, because she won't copy me on things like that, but she uses word of mouth but she also uses texting and emailing to ask."* [Pablo, father of a middle-schooler]

Our observation of existing technology shows that schools and teachers also use personal technologies, but their purpose is to strengthen the presence and outreach of existing textitformal spaces. For example, teachers use email to inform parents about their child's in-class activities and progress. Schools often use text messages, phone calls, and emails to send mass messages to every parent. Mass messages are read-only and do not allow replies.

### Issues to Further Explore

Our analysis of existing technologies revealed four critical issues that the design of current digital tools needs to address: (1) inflexibility in the boundaries of digital spaces, (2) inequality, (3) fragmentation and inconsistency of information, and (4) lack of relevant non-academic information. In this section, we discuss these issues in detail.

#### *Inflexible Boundaries of Digital Spaces*

Parent interviews reconfirmed the ecological nature of effective parental engagement. Within this ecology, parents interact with different teachers, parents, friends, and relatives. As a result, the existing formal and informal spaces in the physical world often have ill-defined boundaries. For example, a formal space could entail the whole school (parents, children, all teachers, etc.), or could only entail one parent and one teacher (e.g., parent-teacher conferences). Likewise, parents can have an informal space where they interact with parents and teachers from different grades and schools. For example, Esther explains how she has leveraged the knowledge of other friends who are parents to receive advice on a better school option for her daughter.

> *"I wasn't that thrilled with the [child's school] experience. So, I was kind of looking for stuff on my own, trying to be an advocate for my daughter and just finding what I could find online. Then when this came up again, my friend who is an attorney said, 'Oh, you forgot about the IB Program', because we were looking at alternatives. I said, 'You know what? I had that in the back of my mind, but I kind of forgot it was there."'* [Esther, mother of 2 middle-schoolers]

It is flexibility in terms of space boundaries what allows parents to garner information for making decisions about how to support their children's education. However, our investigation revealed that the design of existing technologies does not fully account for such flexible boundaries. In these regards, the support of technology to the creation and maintenance of spaces is either too spread out or too restrictive.

From our technology observations we learned that, Class Dojo, for example, restricts interactions by only allowing parents to interact with parents of the same classroom. And even then, it constraints possible ways to interact by only allowing parents to communicate with others through comments they can post on school's and teachers' posts. This lack of opportunities for parents to connect with others hinders possibilities for parents to expand their presence within the parenting ecology. Something similar happens with technologies that support informal spaces between parents and teachers, such as email and SMS. These technologies are good at reinforcing a notion of connectedness and closeness. However, they do not support parents ability to engage in meaningful interactions with more members of the parenting ecology.

In contrast, we observed that technologies such as Facebook allow too many individuals of the parenting ecology to come together. This also impacts negatively opportunities for meaningful interactions. For example, a parent-led Facebook group can have up to 200 to 300 members. This suggests that these digital environments can become overwhelming for many parents. In addition, although members from Facebook groups could include teachers from different classes and even parents from different schools, participation is coming often from the same people. Thus, such technologies discourage many parents from connecting with others in meaningful ways.

#### *Issues of Inequality*

Our observation of existing technology demonstrates that these tools do not adequately support equitable participation among all members of the ecology. This, unfortunately, prevents parents from establishing their presence in the schooling social system.

Technologies specifically designed for supporting formal spaces assume schools should be in charge of initiating communication with parents. For instance, in Class Dojo, teachers have to first post content before parents can make a response. Likewise, in parent portals, teachers generally have to update the site with assignments and grades so that parents can react accordingly. Consequently, parents' roles in these systems are more reactionary and they have little agency.

Even technologies like Facebook, that have not been explicitly designed for schooling endeavors, reinforce inequities. This tends to happen both in formal and informal spaces, and is the result of different design decisions. For example, the establishment of a page ownership (e.g., whoever creates the page owns it) tends to shape participation in digital formal spaces. In these spaces, posts by parents on a school Facebook page can be dismissed or even deleted by school administrators. Although it could be argued that parents are given some voice by being allowed to post, their voices are vulnerable to strict moderation and censorship by a higher, more powerful authority. This, in turn, can make parents feel like the school does not value their opinions. Informal spaces supported by Facebook groups also raise issues of voice. These groups have the potential of broadening parents' access to members of the school ecosystem. However, the interactions we observed in Facebook pages stress that parents need to be cautious of what they post in these groups. Certain topics, such as complaining about a teacher, could get parents in trouble with teachers or school administrators.

In addition, both formal and informal spaces on Facebook lack mechanisms to foster equitable integration of potentially marginalized parents. We observed that in these online communities a select group of members with privileged voice establishes the etiquette and social norms of the space. Parents who are not aware of these norms could, therefore, feel hesitant to participate because of their lack of knowledge of the type of questions or responses that are appropriate. For example, an immigrant parent may not understand what a potluck means and may feel it is inappropriate to ask teachers to further explain the concept. Tacit knowledge is best learned through peer-to-peer communication. As peer-to-peer communication is either restricted or hard to achieve in these spaces, parents are not given the opportunity to teach or learn some of this knowledge.

#### *Fragmentation and Inconsistency*

Both our observations of technology and our interviews revealed that current technology fragments parent-school interactions by distributing information via too many channels of communication. Schools frequently use SMS, Twitter, Facebook, emails, and paper notifications to send information to parents. This issue of fragmentation is worsened by the fact that none of the existing channels can satisfy all the needs of the ecology. For example, Class Dojo allows parents to see what is going on in the classroom, but does not show grades. Parent portals allow parents to see grades, but not what is happening in the classroom. Such high fragmentation can hamper meaningful interactions by overwhelming and preventing parents from making sense of the received information. Parents, such as Monica and Karl, told us how this fragmentation affected their ability to understand the context of the information.

> *"I know [my child's school has been good. They have already invited us to join the Facebook page. If you do Twitter, join this. We got a 16 page newsletter from the PTA in May. I'm like, 'How long is this thing?' But it was great. It gave me so much information. But then because I've never done this before I'm like, 'Is that who I am going to get my information from, the PTA? Or is it going to be from the Facebook page?' How does that work? I don't know."* [Monica, mother of 2 middle-schoolers].

> *"We talk [with teachers], pretty much regularly. For the most part...If I don't get a phone call at least once a week...giving me an update...I get emails. These are the assignments that are due next week, so I hear from them pretty regularly...and it kinda gets a little cumbersome because with one in high school and one in middle school...there are about 8 different teachers that will contact me *snaps fingers* back-to-back, and it seems like they always come at the same time for information. "* [Karl, father of two middle and one high-schooler]

Inconsistency in the way information is managed in some digital formal spaces is also an issue. Parents, such as Marina, told us how this affected their engagement.

Marina (M):*" Because communication is an issue, so we do rely on other parents in the similar grade and we get information about what they are doing in their classrooms and stuff like that, we get information. But some teachers are very good in posting things online so we can go and visit their website and get information and some are not."*
Interviewer (I):*" So do you wish there was more interaction with his teachers?"*
M:*" I don't ... I don't really wish for that. It's not going to change our life in any way but I do feel that if they had a website set up and there is information updated on a regular basis, it does help the child and the parents to kind of stay ahead and be prepared for it."* [Marina, mother of a middle-schooler]

This inconsistency forces parents to seek other mechanisms to access relevant information about their children. Anahi shared how she relies more on her child's memory that on the information delivered by digital formal spaces.

*"The teachers, most of them have websites that let you know when things are coming up. Not all of them do or they are just not able to keep it up or whatever. I understand that too. So just kinda a variety of ways between websites and him telling me and most of the time remembering to study. I just keep asking him, 'Do you have anything coming up this week?' He's usually pretty good about remembering. That's probably the most reliable, is him."* [Anahi, the mother of a middle-schooler]

The information inconsistency of formal spaces negatively affects engagement. It can discourage parental intentions to construct a close relationship with the teacher. This might not be a problem for parents who have already strong connections with other members of the ecology. However, for parents who depend on their relationship with the school and the teacher, inconsistency can impact the entire parent-school relationship.

#### *Lack of Relevant Non-Academic Information*

Current technology supports sharing academic information well. Applications like a school district's parent portal, Class Dojo, and even email can easily, and sometimes immediately, update parents on their children's academic progress. Parent interviews, however, confirm that successfully engaged parents strive for access to nonacademic information important to their child's academic success. Engaged parents, like Jaime, are not hesitant to move beyond the information teacher provides to find out how to provide extra-curricular learning opportunities to their children. He describes the mechanisms he uses to select and garner ideas for learning experiences:

*"Usually every summer we have something that I try to plug them into. A lot of times it's art stuff, because that's hard to fit in and I do consider that academic, because involves a lot of the problem-solving. I sort of watch the kids who are moving and shaking in the school. I'm usually friends with the parents. So word-of-mouth as to 'what is your kid doing this summer?' and then you start finding out about opportunities that may be really good. I find good stuff, I bookmark it or stick it in a folder, and I write it down. Is she going to apply this summer for this program, and when does she need to apply next summer for another program? You kind of put them in the back of your mind so that you might know what some of the criteria might be so that your kids can be ready to be a competitive applicant for some of the programs."* [Jaime, father of 2 high-schoolers]

On the other hand, parents who have issues engaging with the parenting ecology, face a limited access to other members who can share with them opportunities to better assist their children. Their access usually depends on how well they know how to search information or how good their relationship with teachers is. As a result, many of these parents are either not aware of existing opportunities or cannot find opportunities that suites their constraints. For example, Leonor, a working mother of a middle-schooler, shared that her daughter had no regular exposure to non-academic educational support (e.g., out-of-school programs, museum visits, educational books). Her answers suggest this lack of exposure is a result of a lack of interaction with other members of the ecology.

Interviewer: *"What about educational books?"*
Leonor: *"I bought some for her for Christmas."*
I: *"What books did you buy?"*
L: *"I bought like a math book and some writing books. Those are the ones she needs help with the most, her writing skills and math."*
I: *"Okay. How did you find those books?"*
L: *"I just looked."*

Gabriela and Rosa told us how hard it has been for them to look for opportunities on line alone.

*"So, she's interested in everything STEM, you know. I'm challenged with the cost of after-school programs, summer programs. I was online today googling around for affordable programs. There are camps at [local college], they mostly have programs for high school kids. Then I did find something on the Boys and Girls site. Try to get the ball rolling."* [Gabriela - mother of a middle-schooler]

*"He's brought home some things from school, even on the engineering route, just some of them are really expensive. So it's hard to...you know kind of figure that out. Some of the programs, like at colleges, like [name of a local college] or whatever, some of the programs are, you know, pretty expensive. You know like $3,000 to do something like that. So it's kind of hard to."* [Rosa - mother of a 16 year-old]

Our findings show that existing technologies hosted by schools are not effectively connecting parents to the rest of the ecology. Moreover, parents who struggle the most with making connections are not tapping into informal spaces to build those connections on their own. Despite technology facilitating some teacher to parent communication, our interviews indicated that this was not enough for parents to be effectively engaged with their child's education. In order to give all parents the opportunity to engage, parent-school technologies need to go

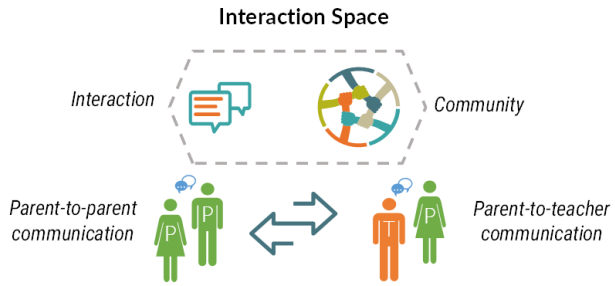


**Figure 1. Interaction Space Overview**

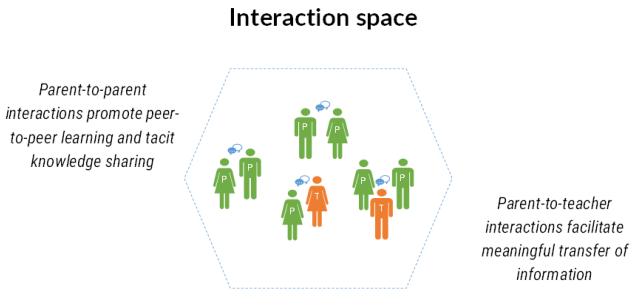


**Figure 2. Single Interaction Space**

beyond providing academic information in three main ways. They need to: 1) enable parents to engage with teachers and other parents in more equitable and open manner, 2) create connections across groups, and 3) expose enable parents to make the most out of the available learning opportunities.

## DESIGN GUIDELINES FOR INTERACTION SPACES

The findings indicate that current technologies do not support community-building amongst members of the parental ecology. Four issues were identified: inflexibility in the boundaries of spaces, fragmentation and inconsistency of information, inequity, and lack of relevant non-academic information. To address these issues, we propose a set of design guidelines for digital interaction spaces. These guidelines will allow parents and school actors (teachers, staff, etc.) to engage in meaningful interactions and come together as an equitable community. (Figure 1). In the following sections, we describe the proposed design guidelines and suggest possible technological approaches that could be used to realize them.

### Support Equitable Informal Spaces

Our findings showed that *informal spaces* are key for parental engagement. These spaces allow parents to connect with other members of the ecology and learn from them. Thus, an interaction space that fosters the parenting ecology should offer members (parents and teachers) equal opportunities take the lead in the communication and on forming groups with other members. To enable equitable opportunities for all members of the space to issue their voice, an interaction space must strive to safeguard privacy and security-a balance that is hard to achieve. Different types of conversations require different levels of privacy. For example, in a conversation around teacher performance, there may be a chilling effect if a parent knows a teacher can view the conversation. Utilizing privacy-by-design principles, parents can have conversations with other parents or form groups that allow proper privacy controls.

### Allow Members to Define Community's Boundaries

Parents do not always connect with parents or teachers from their children's school. Our findings demonstrated that successfully engaged parents transcend the boundaries of the school. In fact, parents can connect and align themselves along a variety of identities, such as ethnicities (e.g., parents of black students in private schools of Chicago) and special needs (e.g., parents of autistic children in rural areas). In addition, as we learned during our technology observations, extremely large formal and informal spaces tend to hinder meaningful interactions. An interaction space should allow members to define the boundaries that best suit their social and communication needs so as to enable all users to exercise their voices.

### Augment Opportunities for Connection

Avenues for information exchanges can maximize resourcefulness of the entire community, increase the diversity of voices and perspectives, and facilitate meaningful interactions. Instead of just a single interaction space, where one community comes together (Figure 2), there can be multiple interaction spaces, each with their own configuration and properties (Figure 3). For example, each space can be a single grade or class. A huge challenge for multiple spaces is the ability to effectively leverage the tacit knowledge of the whole community. This could be addressed by introducing machine intelligence to the system. Approaches such as a generative profile building can allow members across spaces to communicate. For example, a teacher from the third grade, can reach out a teacher from sixth grade to ask a specific question, or a parent (from space A) with some specialized knowledge can help his/her peer (from space B) with a special question.

### Provide a Unified and Organized Source of Information

An interaction space that enables meaningful interactions amongst members should also address issues of fragmentation of information. Our findings showed that numerous channels of communication often bombarded parents with information, which hindered their ability to make sense of that information. An interaction space should offer a unified channel of communication that gathers and integrates information from other channels. Members should be able to define the type and frequency of information they receive. In addition, information in this space should be organized and streamlined in a way that is meaningful for parents. Automation mechanisms fed by user preferences could be used to achieve this goal; for instance, the space can leverage options such as crowd-sourced tagging (e.g., similar to online Stackoverflow forums) or automatic-topic tagging (e.g., similar to the question-answering platform Quora) or a combination of these.

An interaction space should avoid becoming yet another tool that parents have to learn to use to keep up-to-date with school. To address this issue, we suggest leveraging parents' existing

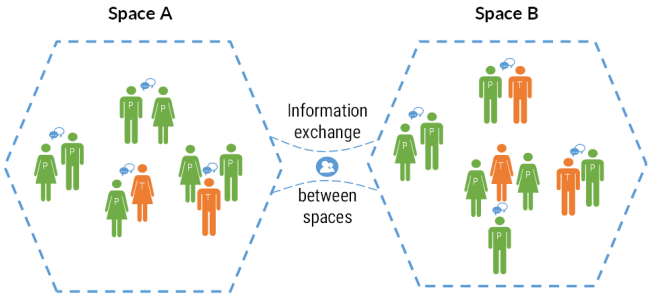


**Figure 3. Connected Interaction Spaces**

knowledge of current technologies (e.g., parent portals, Facebook, text messages, and emails). Features of the interaction space should be inspired from familiar platforms to reduce the learning curve to increase adoption.

### Enable Access to Relevant Information

Access to relevant information, both academic and nonacademic, is vital for parents. We found that successfully engaged parents often resort to a group of teachers and peers as their go-to people for accessing key information. For many other parents, however, effective go-to people are harder to identify. This is especially true for parents who are new to the community or lack social capital or both. Interaction spaces should allow for information to be decentralized and delivered to members of the community in a way that is meaningful to them.

A potential approach for satisfying this guideline is to leverage machine intelligence. The intelligence can match opportunities, parents, events, etc. by indexing the relevant information. Topic modeling techniques can distillate key points in people's interactions. Using the topics most discussed by a user, a profile about that user can be built over time in a generative manner. For example, if the parent of a child engages in a lot of discussions around college opportunities, the system can use natural language understanding and topic modeling techniques to add tags to the said parents profile dimensions. When a new member asks for recommendations on funding opportunities to attend college (a previously indexed topic), the space should have intelligence in the back-end that curates and channels questions to the appropriate parties.

### Make it Matter

Understanding and leveraging motivation of parents is important in designing the space. Broadly speaking, we can design the space taking advantage of parental motivation in three areas: benefit to the child, relevant nonacademic information, and peer-based social communities. In terms of benefit to the child, parental engagement (or lack thereof) about the education system impacts the child's education [16, 12, 4]. As a result, there is value in seeking out meaningful engagement with other parents and teachers.

As our findings revealed, parents want to access relevant nonacademic information. This entails information about extracurricular activities, as well as information around social and cultural norms. For instance, issues around how long should a child stay for a sleepover, what to bring to a potluck, how to organize holiday events in a school, etc. Even if a parent is knowledgeable and successfully engaged to the parental ecology, incorporating a diverse perspective can improve the knowledge base and allow for better parental engagement.

There is also a social benefit to parents if they are engaged. Parents can meet other people who are in similar life stages and motivated by a common goal of engagement in their children's education, which can foster membership into a community. Such facilitated interactions become even more important for working or busy parents who may not have many opportunities to engage in communal activities. In an inclusive environment, parents may feel less intimidated to voice their feelings and concerns.

## RESEARCH AGENDA

There are areas such as privacy, community management, compliance, and sustainability that require further investigation to make the proposed design guidelines robust. The following sections go over the need to investigate further across those four areas.

- **Privacy-related issues**: Since discussions in the interaction space can involve sensitive information, such as grades or (physical and mental) health related, it is important to establish the right balance between privacy and security. To develop privacy-by-design principles, it is relevant to further investigate topics such as cultural factors and the role of anonymity in parent-school interactions.

- **Community Management**: Stewardship of the community is important. However, mechanisms to establish policies and codes of conduct should be designed considering the need to foster equitable interactions. Exploring infrastructures that allow communities to develop codes of conduct should be investigated, rather than assuming a one-size fits all approach.

- **Analytics**: Assessing the impact of an interaction space on parental engagement is key for its sustainability. There is a range of methods that could gather data related to parenting and schools. For example, data on interaction dynamics such as number of messages, average length, and overall sentiment, could be collected to get a rough sense of user engagement. Computing network dynamics, density of network, and average activity in the network could gauge engagement at a sub-group or group level. Further investigation is needed to determine the most optimal criteria of analysis.

- **Formative research with school actors**: While our study was focused on parents needs, formative research with school actors (teachers, staff, and administrators), is important as they are essential parts of the interaction space. For an interaction space to be successful, it will need to meet the requirements of all actors, including issues such as teacher workloads, and administrative challenges in communicating with parents.

## CONCLUSION

Parental engagement should be considered a relational phenomenon that depends on interactive relationships between parents, teachers, and other school actors in the school environment [1]. Our findings reveal critical issues that are not supported by existing technology, restricting meaningful communications within the parenting ecology. To address these issues, we proposed design guidelines for an interaction space and suggest possible technological approaches that could be used to realize them. The interaction spaces in our platform go beyond the communication realm and support parental engagement through community-building. Technology needs to go beyond just facilitating a space for communication. It needs to enhance the inherent dynamic and social component of the communication.

## REFERENCES


1. Angela Calabrese Barton, Corey Drake, Jose Gustavo Perez, Kathleen St Louis, and Magnia George. 2004. Ecologies of parental engagement in urban education. *Educational Researcher* 33, 4 (2004), 3–12.
2. Ronald A Beghetto. 2001. Virtually in the middle: Alternative avenues for parental involvement in middle-level schools. *The Clearing House* 75, 1 (2001), 21–25.
3. Aprile D. Benner, Alaina E. Boyle, and Sydney Sadler. 2016. Parental Involvement and Adolescents' Educational Success: The Roles of Prior Achievement and Socioeconomic Status. *Journal of Youth and Adolescence* 45, 6 (2016), 1053–1064.
4. Eugenia Hepworth Berger. 2003. *Parents as partners in education: Families and schools working together*. Prentice Hall.
5. G. P. Carreon, C. Drake, and a. C. Barton. 2005. The Importance of Presence: Immigrant Parents' School Engagement Experiences. *American Educational Research Journal* 42, 3 (2005), 465–498.
6. Rosario Ceballo, Laura K Maurizi, Gloria a Suarez, and Maria T Aretakis. 2014. Gift and sacrifice: parental involvement in Latino adolescents' education. *Cultural diversity & ethnic minority psychology* 20, 1 (2014), 116–27.
7. James P Comer and Norris M Haynes. 1991. Parent involvement in schools: An ecological approach. *The Elementary School Journal* (1991), 271–277.
8. Grace B del Valle. 2011. Using a Web-Based Program to Increase Parental Involvement: Teachers' and Administrators' Perceptions. *ProQuest LLC* (2011).
9. Betsy DiSalvo, Parisa Khanipour Roshan, and Briana Morrison. 2016. Information Seeking Practices of Parents: Exploring Skills, Face Threats and Social Networks. In *Proceedings of the 2016 CHI Conference on Human Factors in Computing Systems (CHI '16)*. ACM, New York, NY, USA, 623–634.
10. Shannon D Dries. 2014. *The influence of Parent Portal Access on Student Efficacy and Parental Involvement*. Ph.D. Dissertation.
11. Joyce L Epstein. 2001. *School, family, and community partnerships: Preparing educators and improving schools.* ERIC.
12. Weihua Fan, Cathy M Williams, and Christopher A Wolters. 2012. Parental involvement in predicting school motivation: Similar and differential effects across ethnic groups. *The Journal of Educational Research* 105, 1 (2012), 21–35.
13. Susan Graham-Clay. 2005. Communicating with parents: Strategies for teachers. *School Community Journal* 15, 1 (2005), 117.
14. L Grant. 2011. 'I'm a completely different person at home': using digital technologies to connect learning between home and school. *Journal of Computer Assisted Learning* 27, 4 (2011), 292–302.
15. Mara Paich Grujanac. *How does Internet Facilitated Communication impact teacher and parent partnerships?* Ph.D. Dissertation. Loyola University Chicago. `https://www.learntechlib.org/p/124606`
16. Nancy E Hill and Diana F Tyson. 2009. Parental involvement in middle school: a meta-analytic assessment of the strategies that promote achievement. *Developmental psychology* 45, 3 (2009), 740.
17. Martin Hughes and Pamela Greenhough. 2006. Boxes, bags and videotape: enhancing home–school communication through knowledge exchange activities. *Educational Review* 58, 4 (2006), 471–487.
18. Parisa Khanipour Roshan, Maia Jacobs, Michaelanne Dye, and Betsy DiSalvo. 2014. Exploring How Parents in Economically Depressed Communities Access Learning Resources. In *Proceedings of the 18th International Conference on Supporting Group Work (GROUP '14)*. ACM, New York, NY, USA, 131–141.
19. Jane E Miner. 2011. A Parental Response to Online Progress Reports. (2011).
20. Debra Miretzky. 2004. The communication requirements of democratic schools: Parent-teacher perspectives on their relationships. *Teachers College Record* 106, 4 (2004), 814–851.
21. Jill L Murphy. 2009. *Survey study of the relationship between parents' and teachers' perceptions of what constitutes effective school-to-home communications*. Ph.D. Dissertation. Walden University.
22. Elizabeth L Nelms. 2002. The effects of a teacher-created web page on parent communication: An action research study. *Action Research Exchange* 1, 2 (2002).
23. Zehra Ozcinar and Nihat Ekizoglu. 2013. Evaluation of a blog based parent involvement approach by parents. *Computers and Education* 66 (2013), 1–10.

24. Fred Ramirez. 2001. Technology and parental involvement. *The Clearing House* 75, 1 (2001), 30–31.

25. Bridget Somekh, Diane Mavers, and Cathy Lewin. 2003. Using ICT to enhance home-school links: an evaluation of current practice in England: a report to the DfES. (2003).

26. Susan Sonnenschein, Shari R Metzger, and Joy A Thompson. 2016. Low-Income Parents' Socialization of Their Preschoolers' Early Reading and Math Skills. *Research in Human Development* 13, 3 (2016), 207–224.

27. Matt Villano. 2008. Meet the Parents: Notification Tools Can Do More Than Alert the School Community to an Emergency. New Systems Are Cultivating Parental Involvement by Sending Home Daily Reports on Students' Behavior, Attendance, and Performance. *THE Journal (Technological Horizons In Education)* 35, 4 (2008), 48.

28. Yuhang Zhao, Alexis Hope, Jin Huang, Yoel Sumitro, James A. Landay, and Yuanchun Shi. 2013. Hero: Designing Learning Tools to Increase Parental Involvement in Elementary Education in China. In *CHI '13 Extended Abstracts on Human Factors in Computing Systems (CHI EA '13)*. ACM, New York, NY, USA, 637–642.

29. Jolene Zywica. 2013. *Using social media to connect families and kindergarten classrooms*. Ph.D. Dissertation.