The Problem Behind the Problem: Applying Human-Centered Design to Child Care in Flint

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Abstract

In response to the water crisis in Flint, Michigan, USA, early childhood education was one of the targets of intervention and prevention for children who were exposed to lead poisoning, because high-quality child care could potentially help improve their developmental trajectories. The Provider Empowerment Program used human-centered design (HCD) to uncover unmet and overlooked needs among child care providers. We discuss the theoretical framework that guided the project and led to a focus on family, friend, and neighbor (FFN) child care providers. We also present three examples of solutions that were uniquely shaped to meet the needs of FFN child care providers in Flint. Each solution was developed by a process that included taking the perspective of the people who faced the problem, spending time to understand the context of the problem, and uncovering the underlying problem which was not apparent at first. Recommendations for use of HCD in community-based problem-solving are discussed.

Keywords Human centered design · FFN child care · License-exempt child care providers · Flint water crisis

Flint, Michigan, USA is a city that has been in crisis for decades. While the tragedy of the Flint water crisis is well known (Clark, 2018; Hanna-Attisha, 2018) and ongoing, the struggles and challenges facing Flint residents, and Flint's children in particular, did not start with the water crisis. While Flint has the benefit of robust institutions in the areas of health care, culture, and higher education, it has suffered for decades from economic disinvestment, a shrinking population base, and crumbling infrastructure (Highsmith, 2015). As of 2019, there were 7,850 children aged five and under living in Flint. Sixty percent of residents are Black or Latinx, and the median household income is \$28,834, less than half of the median income of nearby majority-white communities with similar educational attainment (United States Census Bureau, n.d.). Today, Flint is demographically one of the poorest cities in the US, with over 63% of children in Flint living below the poverty line (State of Flint Kids, n.d.).

The Flint water crisis began in 2014 when the city of Flint switched its water source and lead leached from corroded pipes into the water system. While the water crisis pushed Flint to the breaking point, it brought particular attention to early childhood education and care because young children are the most susceptible and vulnerable to lead poisoning. The Center for Disease Control and Prevention (2020) warns there is no safe level of lead exposure for children, and long-lasting adverse effects of lead include damage to the brain and nervous system, delayed growth and development, and issues in learning, behavior, hearing, and speech. Consequently these effects negatively influence IQ, attention skills, and performance at school. The relationships between blood lead levels and cognitive outcomes are well documented. For example, blood lead level is related to decreased standardized IQ test scores (e.g., Schwartz, 1994) and achievement test scores in reading and mathematics (e.g., Miranda et al., 2009) in school-aged children. Further, the direct effects of lead exposure go beyond lowering of IQ and educational achievement; for example, Chen et al. (2007) found that even when controlling for lead exposure effects on IQ, blood lead concentration had a direct effect on externalizing behavior and school problems among 7-year-olds.

There is no cure for lead poisoning. While children with lead exposure cannot avoid negative effects of lead on their

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neurodevelopmental abilities, it is believed that early childhood education and care can help reduce some of the negative effects (Educational Services for Children Affected by Lead Expert Panel, 2015). Therefore, early childhood education was one of the targets of intervention and prevention for children who were exposed to the water crisis because high-quality child care could potentially help improve the developmental trajectories among children who were exposed to lead poisoning. Along with other initiatives, such as the establishment of two new high-quality child development centers designed to provide wraparound care for children and families, our project was funded with the goal of providing comprehensive support to early childhood care providers in Flint.

In Fall, 2018, we began a design process to create the Provider Empowerment Program (PEP), with the aims of building trust, making local connections, and understanding the particular needs of child care providers in Flint. In this paper, we discuss the theoretical framework that guided the project and the human-centered design (HCD) approach that led to a focus on family, friend, and neighbor (FFN) child care providers and to unanticipated discoveries of their unmet needs. Through this process, in many cases we were able to uncover "the problem behind the problem," meaning the underlying issue that contributes to or creates a problem experienced by an FFN child care provider. To illustrate this process, we present examples of three solutions that were uniquely shaped to meet the needs of FFN child care providers in Flint.

Ecological Framework

A child's development happens within a system that includes multiple interacting environments (e.g., family, child care, and community). With our project's focus on the child care environment, we found Bronfenbrenner's (2005) bioecological model of human development, which emphasizes the importance of dynamic, developmental relations between an active individual and their complex, integrated, and changing environments, to be a useful framework. In this framework, the relations between the developing child and the immediate environments that they belong to, such as home or child care, are considered to be microsystems, and these are where the basic processes of child development occur. Outside a child's own family, child care is one of the most important environments because it is a place where children have many crucial interactions. Moreover, relationships between microsystems constitute mesosystems, and they also play a role in child development. For example, the relationship between family members and child care providers can influence a child's development—positively or negatively. When family values are understood and shared by

child care providers, that shared understanding can influence a child positively because the child is nurtured similarly. On the other hand, if a family's values are not shared by child care providers, this might create confusion for the child. All these microsystems and mesosystems surrounding a child are influenced by an overarching environment called a macrosystem, and it encompasses outermost influences such as social policies and culture. One could argue that the Flint water crisis has influenced a whole ecological system for the people in Flint.

Therefore, improving child care for children who were exposed to the Flint water crisis is not just a matter of improving curriculum, provider qualifications, and the physical condition of facilities. We began our project by examining the ecosystem of child care in Flint and what was needed to increase the quality of child care for children and families. Once we began the project, we realized quickly that no one seemed to be looking at the whole ecosystem, and most importantly, no one seemed to be able to articulate what child care providers' needs were from the providers' own perspectives. Following the public exposure of the Flint water crisis, government stakeholders, funders, and social service agencies swooped in to help, bringing solutions that centered around the delivery of child care. New centers were opened; a state-of-the-art child care facility appeared. Everyone seemed to agree that child care was an important part of child development and that efforts needed to be made on many fronts if children in Flint were to thrive. What was missing, however, were the perspectives of families and child care providers. Without those perspectives, how could we even know what the underlying problems were, and how these problems fit into the larger ecosystem of child care? On top of an ecological framework to examine the system, we needed an approach that could help us uncover the problem behind the problem.

Human-Centered Design

How does one begin to solve a problem when it is not clear what the problem is? The answer for us was an approach called human-centered design (HCD). The word *design* may conjure images of physical objects, like furniture or appliances, or perhaps graphics or computer software. But any planned solution to a problem can be a design, and such designs can include things that are not physical or material, such as processes, policies, or the implementation of policies (Brown, 2008; Norman, 2013). HCD helps people develop solutions to problems that focus on human needs, especially problems that are complex, ill-defined, open-ended, or messy (Brown, 2008). HCD starts with spending time understanding the context and the people involved, considering whose needs to focus on, determining what the

problem looks like from their perspective, and identifying which goals are most important to them.

For PEP, we used a design process developed by one of the authors, based on models described by Tschimmel (2012) and others. In this process, HCD is carried out in six phases: *discover*, *frame*, *imagine*, *prototype*, *engage*, and *reflect* (see Table 1). These phases are not rigid or lockstep, but rather comprise a flexible roadmap for doing HCD work.

While one might assume that the most important part of a design approach is the *imagine* phase (i.e., coming up with solutions), in fact the most important part of the process is framing the problem. *Framing* is the process of describing a problem in a way that gets beyond the surface characteristics of a problem. And the key to framing a problem is taking the perspective of those who actually have the problem and understanding their experiences. If we are working on the wrong problem, or we have chosen the wrong people's needs to focus on, no amount of effort will result in an effective solution. It is crucial, therefore, to hold off solutioning until we have a deep understanding of the problem.

HCD can be thus described as a combination of perspective-taking and reasoning. The designer must see the world from the perspective of the person who has the problem, which means listening carefully; making observations; and gathering knowledge, including evidence from research. Only after this extensive process should the designer propose potential solutions. It is crucial that before deciding on long-term solutions, the solutions are quickly tried (prototyped) and tested, and feedback is gathered through engaging with participants to make sure that the solution meets

the needs of the person who has the problem, from their perspective. If the needs are not met, solutions must be reimagined, and sometimes the problem must be reframed, but ultimately it is up to the person with the problem to decide if the solution is valid.

In this way, framing is a process of uncovering needs and identifying the problem behind the problem. At this stage, it is crucial to put aside assumptions and hold off on solutions, however appealing those solutions may seem. When this framing process is skipped or cut short, it can lead to solutions that do not fully meet people's actual needs. For example, in the initial flood of support for children in the wake of the Flint water crisis, the assumption was that children in Flint needed more formal child care options, and the solution was to increase the capacity and quality of child care centers and licensed child care providers. While this solution did meet some needs, through HCD we uncovered another whole set of unmet, unrecognized needs in Flint's child care ecosystem.

Focus on Family, Friend, and Neighbor Child Care

PEP was born from the idea that we should identify the needs of child care providers first, then propose solutions around those needs. When we began, in 2018, we thought we would initially focus on private child care centers and licensed providers, and start building rapport, identify their needs, and eventually propose ways to support them. When we contacted them, however, the most common response, when they responded at all, was, "I'm good—Organization X [pseudonym] is helping me." We had hoped that we could start conversations with child care providers by asking what challenges they had and what their wants and goals were, but we were unable to even take that first step.

Since we were not uncovering many problems by simply contacting child care providers, we decided to probe the minds of the staff of Organization X, a community-based organization providing services to child care providers in the region. The PEP team met with Organization X, with the goal of discovering where the largest unmet needs were among child care providers in Flint. We did not want to address a problem that Organization X or another organization was already addressing effectively, and we wanted to choose a focus area where our design process could have a substantial impact. As a result of this activity, we identified family, friend, and neighbor (FFN) child care providers as having the most urgent unmet needs in Flint, and they became the focus of the *frame* phase of our design process.

Child care is not just one thing. In policy discussions and in the media, child care tends to mean formal, licensed child care programs or large federally funded early intervention

Table 1 Human-centered design process

	Phase	Description
Discover	Learn about the situation and the people involved
Frame	Define the problem
Imagine	Invent potential solutions, processes, or approaches
Prototype	Create a mock-up
Engage	Test the prototype and receive feedback
Reflect	Analyze feedback and iterate the design

programs, like Early Head Start and Head Start. However, the reality of child care is a spectrum, including centers, licensed in-home care, and FFN child care. FFN providers include extended family (e.g., grandparents, aunts, uncles, and cousins) as well as trusted nonrelated friends and neighbors.

In the US, an estimated one third of children 5-years-old and younger receive some sort of FFN care; many receive multiple types of care. For children 2-years-old and younger, FFN is the most common type of nonparental child care (Mamedova & Redford, 2019). Additionally, low-income families are more likely to use FFN care (Susman-Stillman & Banghart, 2008). For families in "child care deserts," which are areas where the supply of formal child care falls well short of demand, FFN care may be the only feasible option. Child care deserts are particularly common in areas that have one or more of the following characteristics: lower median incomes; large minoritized populations; and low population density, such as rural areas (Center for American Progress, 2020).

Even in areas with other child care options, many parents choose FFN care. Flint has dozens of child care centers, including school-based federal programs, many of which are free to families who meet income requirements. However, centers serve only a fraction of families who need child care in Flint, and many eligible children do not attend center-based programs. While the research on the choices parents make about child care does not specifically focus on Flint, it does point to a number of factors that influence where parents decide to send their children for child care.

One of the factors that impacts the type of child care services that parents seek is their work schedule. Lower paying jobs in particular often require hours that do not fit with a traditional child care center schedule. Parents may need to work evenings, nights, early mornings, or weekends, and work schedules may change week to week. Another factor is that many parents tend to trust family and friends more than institutions, leading them to choose FFN care, especially when extended family or close friends are nearby. Furthermore, institutional preschools may be seen as not sharing the parents' values and culture and may even be perceived as racist (Dow, 2016), a view that is not unfounded (U.S. Department of Education Office of Civil Rights, 2014).

Based on the research cited above and our meeting with Organization X, we made FFN child care providers the main focus of the PEP project. Our goal was to understand FFN child care providers' challenges in the providers' own terms and help them overcome those challenges in ways that ultimately helped children and families in Flint. The PEP team spent nearly a year gathering information related to FFN child care providers. We set up tables at community events and gathering places, such as the farmers' market, in order to reach out to people who were FFN child care providers

but may not have considered themselves to be "child care providers." We researched the state subsidy system, becoming familiar with forms, policies, and procedures, in order to understand the challenges that FFN child care providers faced when trying to access subsidies. We learned about social services available in Flint and the organizations that provided those services in order to better understand what support systems were available to help meet FFN child care providers' full range of needs. In order to open channels for communication so that we could continue to listen to their needs, we used different methods of communicating with FFN child care providers as a group, including Facebook, a website, a YouTube channel, and a text message group. In the process, we were able to listen to many different FFN child care providers and understand their needs and perspectives better.

The needs we uncovered were well suited for an HCD process because in addition to some challenges common to many FFN providers, each provider had unique, complex challenges that required individualized solutions. Much of PEP's work involved uncovering these challenges, taking the providers' perspective, understanding their needs, and devising solutions together with the child care providers. Each provider's situation, therefore, was a kind of mini-HCD project.

Applying HCD to FFN Child Care: Three Examples

The following examples illustrate three cases in which we applied an HCD approach to FFN child care providers' challenges. These examples demonstrate how framing the problem well helped us discover the problem behind the problem in each case. The first two cases involved small problems that we were able to address relatively easily, although it took some work to frame the problems in ways that led to better solutions. The third case was much more complex, and HCD helped us uncover multiple layers of challenges and develop novel solutions to some of these issues.

Example 1: The Water Pump

Although in 2018 the state of Michigan declared Flint's water safe to drink, most residents did not believe this was the case. In 2021, there were still a number of free water distribution services operating throughout the city. Free water distribution tended to come in the form of packs of plastic water bottles, and while this met the need for clean water, it created other problems for FFN child care providers. Plastic bottles create two kinds of waste: wasted water when the bottle is opened but not finished, which is common among children, and the bottle itself. The challenge that came to our

attention through discussions with FFN child care providers, who were juggling multiple demands and did not want to be in charge of distributing water each time a child needed a drink or keeping track of each child's water bottle, was that children needed a way to independently get the amount of water they wanted when they wanted it. Additionally, this could be a great learning opportunity for children to be independent and obtain self-help skills as well as an opportunity to practice small motor skills.

After careful consideration and cost analysis of options, such as an office-style water cooler that is useful but expensive and requires lifting a heavy water jug into place, we discovered a commercially manufactured hand pump, costing about \$10, that fits on top of a standard 5-gallon jug placed on the floor. The jug can be refilled inexpensively at supermarkets or for free at Water Box stations that provide safe filtered water at community centers and churches in Flint. We bought pumps for two providers, asked them to use them in their child care settings, and then asked them for feedback. The providers told us that the pumps met their needs sufficiently, and we eventually offered the pumps to our entire FFN child care provider network. In retrospect, this seems like a simple solution; however, many child care providers indicated that water was an important need and that the waste generated by water bottles was a pressing issue, but none of the providers could think of solutions. At first the problem seemed to be, "How can child care providers reduce the amount of wasted water and trash/recycling?" but after careful listening, we were able to reframe the problem as, "How can children get the amount of water they want, when

they want it, by themselves?" This is an example of how an HCD approach can lead to a better solution by uncovering the underlying problem, considering all the constraints from the child care providers' perspective, reframing the problem, trying a prototype solution, getting feedback from those who tried the prototype, and making a decision based on feedback as to whether to disseminate or revise the solution. In Table 2, we describe this example in terms of the full HCD process.

Example 2: The Pack 'n Play

In one of our routine conversations with FFN child care providers, one provider, Amber (pseudonym), had indicated an immediate need for a Pack 'n Play portable sleeper for her infant granddaughter, Briana (pseudonym). While PEP's main purpose did not include giving material donations to providers, we occasionally provided material goods in response to specific needs (like the water pumps described above). We could have quickly responded to her request by buying a Pack 'n Play for her; however, we wondered, "What is the underlying problem that Amber is trying to solve with the Pack 'n Play?" In other words, a Pack 'n Play was proposed as the solution, but a solution to what?

After conversations with Amber, we discovered that she needed a way for Briana to sleep safely while Amber focused on other tasks. Once PEP understood her need, it became clear that a Pack 'n Play was not a particularly good solution: Briana would quickly grow to the point where she could climb out of the Pack 'n Play, which would create a danger

Table 2 Design process of example 1

	Phase	Operations
Discover	We observed and listened to child care providers and noticed that while providers were giving children individual bottles of water because the tap water was not trusted, these bottles wasted water and created trash, and took time for the provider to manage
Frame	Based on what we learned in the <i>discover</i> phase, we defined the problem as "Children need a way to get the amount of water they want, when they want it, by themselves."
Imagine	We investigated several potential solutions, including faucet filters (not trusted enough by Flint residents to remove all lead), office-style water coolers (too expensive), and picnic beverage coolers (expensive and unwieldy to dispense and refill). An inexpensive hand pump for standard 5-gallon water jugs had the best potential to meet all needs
Prototype	Hand water pumps and jugs were commercially available and inexpensive, so we merely needed to purchase them for testing
Engage	We gave pumps and 5-gallon jugs to two providers, asked them to try them with children in their care, and then asked for feedback
Reflect	Feedback from providers told us that the hand-pump solution solved the problem well, but it generated some new challenges, including transportation to and from water distribution sites, and the fact that full 5-gallon jugs can be too heavy for elderly providers to manage easily. Meanwhile, the city began replacing water service lines of affected homes for free, and we have encouraged providers to take advantage of this as a long-term and sustainable solution

in itself. We reframed the problem: Amber did not need a Pack ‘n Play specifically; Amber needed to be able to focus on other tasks while Briana rested safely. To understand the situation better, we visited the house and listened to Amber’s other needs. We discussed her living room environment where she spent most of her time with Briana and proposed a variety of safety equipment that Amber could install in her house. PEP purchased equipment, such as gates, table bumpers, outlet covers, and a child carrier, and then made another home visit to help Amber install the safety equipment and use the child carrier. This is another example of reframing the problem by uncovering underlying needs. We could have responded to Amber’s request and quickly moved on, but by using an HCD approach, we were able to come to a more lasting solution that met Amber’s underlying needs better and improved her child care environment. This example maps onto the HCD phases as described in Table 3.

Example 3: Barriers to Receiving Subsidies

Through conversations with providers, community organizations, and government agencies, we discovered that despite the existence of federally funded, state-administered Child Development and Care Program subsidies for children in FFN child care, these subsidies were being accessed by only a small fraction of the estimated number of FFN child care providers in Flint. FFN providers were eligible to receive state subsidies through the families of the children they cared for as long as the provider applied for and received "license-exempt" status from the state

and as long as the family met eligibility requirements. The state shared with us that in April 2020, only 855 children in license-exempt care in Flint received child care subsidies, which was roughly 11% of children ages five and under in Flint. We cannot know the exact number of children in Flint who received FFN child care or the total number of child care providers who could have been eligible to receive subsidies, as they do not show up in administrative data related to child subsidies that are being collected by the state. However, based on national data about the percentage of children receiving FFN child care together with Flint’s median household income, it is reasonable to assume that many eligible FFN child care providers in Flint were not accessing subsidies.

From 2015 to 2019, the median household income in Flint was \$28,834 (United States Census Bureau, n.d.), and the entry level for subsidies before 2020 was 130% of the poverty level (\$39,300 for a family of four). These statistics indicate that the vast majority of children 5 years old and younger in Flint were likely to come from families eligible for subsidies. Yet even among license-exempt providers in Flint, only about 40% billed the state in any given month according to administrative data. Additionally, most license-exempt child care providers did not take the 10 h per year of approved training required to gain a higher level of license-exempt status (from Level 1 to Level 2) that could significantly increase their subsidy rate. Further, it was not the case that most subsidy-eligible children in Flint were receiving subsidies through licensed care; as of 2019, only 36% of children in Flint received subsidized licensed care,

Table 3 Design process of example 2

Phase	Operations
Discover	When Amber requested a Pack ‘n Play, we looked for the problem behind the problem by asking, “What problem are you facing, and why do you think a Pack ‘n Play is the best solution?” We listened to Amber describe the challenge in detail and made a visit to observe the child care space. We also took note of Amber’s physical needs and future goals
Frame	After the <i>discover</i> phase, we discussed with Amber how to best frame her problem. Eventually we arrived at, “Amber needs a way for Briana to sleep safely while Amber focuses on other tasks.”
Imagine	We brainstormed different ways to meet Amber’s need as framed above, and identified a child carrier as a possible way for Briana to sleep safely while Amber worked, and child safety equipment as a way to make the space safer for Briana to explore in general. We proposed these solutions to Amber and she agreed they were worth trying
Prototype	We gathered 3 different child carriers and a range of child safety equipment to try at Amber’s house
Engage	We came to Amber’s house with the child carriers and safety equipment. Amber tried on each of the carriers and identified the one that fit best and was most comfortable. We installed the equipment and identified areas where more equipment would help Amber use her space more effectively
Reflect	While this solution met Amber’s current needs, her future goals include caring for more children and starting a licensed child care business in her basement space. As her situation changes it will be necessary to revisit each of the stages above, reframing the problem and designing new solutions as necessary

which was also far lower than what would be expected given Flint's median household income.

All of this means that a great deal of money is being left on the table—money that could be supporting the welfare of children in Flint—which led our team to ask the following: Where are those children? Why are so few children receiving child care subsidies? Why are many license-exempt providers not billing the state for allowable/eligible subsidies? Those were the questions that we began with.

As we pursued these questions, we found various factors were preventing license-exempt child care providers from accessing subsidies and preventing other FFN child care providers from attaining license-exempt status so they could be eligible for subsidies. Subsidies can make a crucial difference in the ability to provide quality care, but navigating through the state system was difficult and many challenging factors existed:

- Awareness: Through our information gathering described above, we found that many people who took care of a family member's, a friend's, or a neighbor's child did not consider themselves to be child care providers. They did not know they might be eligible to receive support and resources. Those who did recognize that they were child care providers often did not know they could receive subsidies without becoming licensed.
- Application: Although it is much simpler to gain license-exempt status than to become a licensed child care provider, filling out the required paperwork and attending the state-mandated 1-day orientation present barriers for many FFN child care providers.
- Complexity: When license-exempt child care providers billed for subsidies, the subsidy checks from the state went to the parents rather than the child care providers. Providers had to make arrangements on their own for the parents to pay them in order for the providers to receive the subsidies, and this did not always go smoothly, as the majority of FFN child care providers were family members and family dynamics could come into play.

Navigating the system was complex and we took this as an opportunity for us to become more familiar with the system and examine the issues deeply. We met with a variety of stakeholders, such as state and advocacy/policy organization representatives, to understand the system better so that we could support FFN child care providers more effectively. Also, we examined the availability and accessibility of free courses that would help satisfy the 10-h training requirement for license-exempt child care providers to progress from Level 1 to Level 2. While having free courses means that cost is not a barrier, and the financial gains of moving to Level 2 are substantial, many providers did not take advantage of this opportunity. We discovered multiple barriers,

such as lack of familiarity with and access to the technology necessary for online courses and issues related to location, scheduling, and transportation for in-person courses, that hindered FFN providers from seeking higher license-exempt status.

Understanding the situation in this way, and being able to see the challenges of accessing the subsidy system from a provider's perspective, led us to prototype a number of solutions, including creating new informational materials explaining the license-exempt application process; reaching out to FFN child care providers through phone and text messages, our website and social media, and in person; training our team to be Health and Human Services Navigators who have access to the state public assistance system in order to help providers troubleshoot the subsidy system; and giving providers direct technical assistance with online billing and training. Given the multilayered nature of the challenges associated with increasing awareness of the subsidy programs, applying for license-exempt status, and overcoming the complexities involved in obtaining the subsidies (as described above), our solutions were only able to partly address the identified problems. The identification of particular public policy decisions that directly impacted FFN child care providers, together with the realization that full solutions could only come with changes in public policy and implementation, led us to create a sub-project focused on policy research and advocacy as a next step. This example maps onto the HCD phases as described in Table 4.

Discussion

When a community is in crisis, it is tempting to rush in with solutions. In the urgency of the moment, we may believe that we already know what the solution should be. In fact, though, we may not have a clear view of the whole picture, and thus we might not have a solution that addresses the real problem. Starting with an ecological framework draws attention to the interconnected systems that support child development, and for children and families who were exposed to the water crisis, child care is a crucial part of this ecosystem. Examples 1 and 2 portrayed problems that FFN child care providers were facing at the level of a child's microsystem, which had an immediate influence on child development. Through these solutions, FFN child care providers could care for children more effectively by overcoming the problems that they had. The water pump solution in Example 1 could support children's small motor and self-help skills as well as social-emotional development by helping them feel independent and by encouraging them to help their peers in the child care setting. Additionally, children could contribute to reducing water waste as good citizens of society. In Example 2, Briana's learning environment was significantly

Table 4 Design process of example 3

Phase	Operations
Discover	We asked FFN providers how the subsidy system was working. We listened to FFN providers regarding their concerns about billing and met with local organizations and government agencies to identify areas of unmet needs among FFN child care providers
Frame	It became clear that large numbers of eligible and potentially eligible providers were not accessing state subsidies. We identified particular factors that created barriers to accessing the subsidy (awareness, application, complexity), and framed the problem as, “FFN providers need ways to become eligible for and access available subsidies with fewer barriers.”
Imagine	We considered a variety of potential solutions that could address the factors we identified. Potential solutions included information dissemination, direct technical assistance, and trainings, as well as some that we decided were not feasible, such as creating business co-ops to handle the administration of subsidies
Prototype	We developed several prototypes for the solutions we had imagined, including a comprehensive informational website, a group text message system, a social media strategy, and direct assistance with subsidy application and billing
Engage	We implemented the prototypes described above and gathered feedback from providers we assisted
Reflect	Based on the feedback we received, we learned that information and direct assistance can help in the short term, but long-term solutions must involve policy change. This led us to go back to the <i>imagine</i> phase and develop prototype policy recommendations. We engaged with state agencies and advocacy groups around these recommendations, leading to further refinement and development of advocacy goals

improved through effective structuring and changes made to her physical environment. Example 3 represents a problem that influences child development at micro-, meso-, and macro-system levels. At the microsystem level, if FFN child care providers do not receive subsidies, although children are eligible, that is simply a loss of resources that can be used for children. When FFN child care providers do not receive subsidies from the families due to their family dynamics, it creates a conflict in the mesosystem between FFN child care providers and families of children. After several attempts to solve this problem at the microsystem level, we realized that this problem is rooted in the macrosystem; it resides beyond micro- and meso-systems, and needs to be solved by policy and/or implementation changes to the child subsidy system. These examples clearly show the importance of an ecological framework for examining the child care ecosystem, and they confirm the useful application of this theory.

Limitations

PEP attempted to improve child care in Flint by identifying the problems that FFN child care providers faced and by designing solutions that met as many of their unmet needs as possible. The examples above describe some of our successes, but there were many problems we did not have the time and resources to address, and many providers we were not able to reach. In addition, the COVID-19 pandemic began during the last year of project funding. We

were forced to shift all activities and interactions to a virtual format, which posed additional challenges to many FFN child care providers, and that limited the opportunities to co-design solutions.

Finally, while an HCD approach has been an essential framework for our activities, by itself it does not guarantee success. Designing effective solutions in PEP required expertise in child development, relationships with community organizations and government agencies, effective project team management, and extensive efforts to build trust in the community. Even so, not all of our problem-solving efforts were successful, and making our successes sustainable is yet another challenge.

Lessons Learned from Applying HCD

There are several lessons that we have learned through this project. First, the solutions discussed above could not have been reached without a thorough discovery and framing process. By emphasizing the framing of the problem, HCD helps us make sure that first and foremost we are working on the right problem. As the three examples above illustrate, for even small challenges, framing the problem is the most difficult, most time-consuming, and most important part of the process. Framing the problem well depends on carefully observing and listening, patiently gathering knowledge, and empathetically taking the perspective of the people in need.

Most people do not think about problems in the areas of child welfare and child care/education as design problems,

and they do not necessarily see solutions to these problems as something to be designed. However, considering these problems as design challenges reminds us that proposing solutions to human challenges is a process—a process that requires perspective-taking, observation, and experimentation.

Second, HCD itself does not provide solutions. Proposing a better solution takes time, knowledge, and imagination. HCD does, however, provide a tool for helping us avoid pitfalls and jumping to conclusions without considering all the factors that may influence the problem. For example, directly asking people what they want is usually not enough to understand a problem fully because people tend to propose solutions without fully exploring a problem, even a problem of their own (as Amber did in Example 2 above). Instead, we should spend time understanding the problem a person is facing to frame the problem most accurately.

Third, HCD also helps us avoid another common pitfall: applying solutions that have worked elsewhere without fully understanding the current problem. In Flint, many responses to the water crisis involved solutions, such as increasing the capacity of formal child care centers, that did not reach many families in need. Through an HCD approach, we discovered that the greatest unmet need was for FFN child care, although the majority of support had not been directed to that type of child care. A solution that works well in one community may not work in another. It is crucial to find out what the community actually needs by taking their perspectives and understanding their problem. By putting these perspectives front and center, HCD can be a way to take steps toward more inclusive, more equitable problem-solving.

Implications

Ultimately, these HCD steps must include empowering child care providers to design their own solutions. This is not simply a matter of providers knowing the concept of HCD; HCD is best learned through practice, with others, working on a problem that is relevant and real. Crucially, in order to practice HCD, providers need time to build their understanding of their own challenges and think broadly about potential approaches, as well as the resources to prototype and revise solutions that will probably not succeed on the first try. This can be implemented through providing support and guidance, and/or working collaboratively when FFN child care providers share their concerns with community based organizations or agencies that support FFN child care providers. Professional development seminars or workshops can be an entry point to HCD, but ultimately an HCD approach is best learned by working together as a team on real issues that FFN child care providers face.

Of course, time and resources are in short supply for child care providers, especially for FFN providers, and we realize that an HCD approach does not often fit well with the ways in which public health and welfare programs are funded. With PEP, we were fortunate to have a funder that gave us time to discover needs, try out a range of solutions, gather feedback, and adjust course accordingly, so that in the end PEP was a very different project than what was originally envisioned. However, governments and private funders often prefer to support programs that are already shown to be evidence-based and scalable, and that represent established best practices. The initial ambiguity inherent in HCD can make projects appear risky because the problem and solution are not well defined in advance. Most grant applications ask applicants to define the problem in detail in advance, and say exactly how the outcomes will be measured. However, we urge policymakers, funders, and researchers to embrace the potential risks and rewards of HCD, and when presented with best practices and effective solutions to ask the following: Solutions to what? Effective based on what criteria? Best practices for whom? Only then can we move past one's own perspective and uncover the problem behind the problem. While HCD might take longer than other approaches, it can lead to more effective and meaningful solutions for projects and programs that aim to support people in need.

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