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USER RESEARCH METHODS FOR DEVELOPMENT ENGINEERING: A STUDY OF METHOD USAGE WITH IDEO'S HCD CONNECT

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ABSTRACT

While there is increasing interest in designing for the developing world, one major challenge lies in understanding when to apply different design methods in unfamiliar contexts. This paper uses HCD Connect, an online design case study repository, to compare what types of methods people frequently apply to developing world problems. Specifically, it covers how the following factors correlate to method usage: application area (*e.g.*, farming versus healthcare), affiliation of the person using the method (IDEO designer versus not), and stages of the user research process. We find that designers systematically use certain types of methods for certain types of problems, and that certain methods complement each other in practice. When compared with non-IDEO users, professional designers at IDEO use fewer methods per case and focus on earlier stages of the process that involve data gathering. Our results recommend certain kinds of user research methods for different developing world problems, as well as identifying which research methods complement each other. It also highlights that professionals designing for developing world contexts commit more time to earlier stage data-gathering efforts, rather than in concept generation or delivery, to better understand differences in needs and design contexts.

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INTRODUCTION

Over the past decade, designers have increasingly applied Human-Centered design and user research methods to developing-world issues. User research methods are tools used by designers to analyze the needs of the people they are designing for. For example, before designing a healthcare monitoring device for rural villages, a designer might travel to representative villages and apply user research methods such as observation or interviewing to uncover the user needs or functional requirements that their design should satisfy.

While academic institutions and industry firms alike recognize the importance of using appropriate user research methods, many designers struggle to choose the right method for new and unfamiliar contexts. Should one use the same methods for a project on rural agriculture as one would for maternal health, and if not, which methods work best for each? If one is already familiar with one method, how can one best complement his or her knowledge by selecting new methods that work well together? Answering these questions requires a better understanding of how user research methods complement one another and how their usage changes in new contexts that are different from our own.

To that end, this paper expands the application of design thinking to nonprofits and social enterprises that work with low-income communities by analyzing the usage patterns of different user research methods in the Human-Centered Design (HCD) Toolkit developed by IDEO, an award-winning global design

firm. In particular, we look at HCD Connect, an online platform run by IDEO.org. HCD Connect distributes a user research method toolkit and provides a forum where designers can post case studies of different developing world problems. These cases describe the user research methods a designer used to address a particular design problem [1, 2], and cover the 39 methods included in the HCD Toolkit. HCD Connect categorizes their user research methods across three different design stages:

"Hear: Determine who to talk to, how to gather stories, and how to document your observations.
Create: Generate opportunities and solutions that are applicable to the whole community.
Deliver: Take your top solutions, make them better, and move them toward implementation." [1]

We provide a brief summary of the 39 methods in IDEO's HCD Toolkit in Tables 4–6.

After providing some background on development engineering and the application of user research methods in design, this paper presents our four main research questions, answering them in sequence through a descriptive statistical analysis of 809 case studies from HCD Connect:

1. How does method usage vary across the entire case study corpus?
2. Which methods complement one another?
3. Which methods are more or less useful for different kinds of development engineering problems?
4. How does method usage compare between professional designers at IDEO and the rest of the HCD Connect community?

We follow our results with some discussion about user research methods in design for development projects.

PRIOR STUDIES OF DESIGN FOR DEVELOPMENT METHODS

Since this paper covers user research methods in design for development, it builds off of two primary research areas: design for development and categorizations of user research methods.

Design for Development

Design for development integrates appropriate technologies with economic and social development [3]. In order to develop effective, scalable, and sustainable products or services in developing regions [4, 5], designers need to deeply understand the social factors, cultural context and needs of their intended users [6]. However, understanding user or customer needs can be challenging when designers come from a different cultural

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[1] http://www.hcdconnect.org/toolkit/en

and socioeconomic background than their intended users. Design Thinking or Human-Centered Design (HCD) methods provide a range of techniques and tools that engage potential users and customers in the design process, identifying their needs and generating solutions [7, 8, 9]. Only recently have HCD methods been integrated with earlier work in design for development and social innovations [10]. Winters provides an excellent example of work that combines appropriate technology development with design thinking approaches to wheelchair design in the developing world [11, 12].

In terms of discussing and learning design for development methods, the D-Lab [13], under the direction of Amy Smith of MIT, uses a capacity building approach [14] to immerse community members as co-designers in 3–5-week International Development Design Summits (IDDS) to inspire and enable people with a range of expertise (*e.g.*, mechanics, students, teachers, doctors, economists, priests, masons, and artists) to create technologies for poverty alleviation. IDDS brings together over 60 people from more than 20 countries worldwide to form design teams that increase income, improve health and safety, decrease manual labor or save time [15]. These IDDS participants learn the design process through lectures and hands-on workshops, in contrast with this paper which focuses on design for development methods as discussed in HCD Connect's online community.

Categorizations of User Research Methods

Researchers have been developing and discussing appropriate user research methods for decades, with yearly conferences devoted to the topic (*e.g.*, EPIC[2]). Many authors have written books cataloging or otherwise classifying design and user research methods. Coming from the field of architecture, Geoffrey Broadbent's work [16, 17] seeks to understand design methods through the lens of how the designed artifact interacts with various stakeholders, such as the humans who use the design or the environment the design will be situated in. Others view design as a temporal process, and organize design methods according to which stage of a design process a method is most appropriate. For example, Christopher Jones [18] divides the design process into three sequential stages (Divergence, Transformation, and Convergence), allocates methods according to each stage. IDEO's HCD Toolkit is most similar to this organization, in that its Hear, Connect, and Deliver stages follow each other in time.

Design and user research methods vary along many factors, and their widespread proliferation and expansion has been recently addressed by websites that collect and categorize methods along multiple dimensions. For example, the Helen Hamlyn Centre for Design at the Royal College of Art operates "Designing with People" [20], a collection of user research and design methods that categorizes research methods by their inputs and outputs, the stage of the design process, the relationship of the

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[2] http://epiconference.com/

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method to the people who will use the design, and the type of interaction afforded by the method. Roschuni *et al.* [22, 21] use ontologies to not only categorize method dimensions, but to understand how those dimensions interact with one another. Their goals resemble those of HCD Connect, in that they are compiling design case studies to act as an educational resource for designers.

This work builds off of these prior efforts by providing an analysis of user research methods specifically in the application area of design for development. It demonstrates how factors such as problem type affect the type of methods used. Much of this paper's analysis and methods can directly inform current research in categorizing user research methods.

RESEARCH METHODS

The dataset we use consists of 809 case studies posted to HCD Connect between June 2nd, 2011 to September 13th, 2013. Figure 1 shows an example of what a case study contains: (a) text and pictures describing the problem, (b) information regarding the user who submitted the case, (c) a list of development "focus areas" which categorize what type of problem the case was solving, and (d) a list of the HCD Toolkit methods that the case used to address the problem.

For (b), we keep track of the organizational affiliation of the person who submitted the case, classifying the person as a member of "IDEO" if their organizational affiliation contained the string "IDEO" and classifying them as "non-IDEO" otherwise. IDEO members are typically industrial designers within IDEO, organizers within IDEO.org (IDEO's non-profit arm that operates HCD Connect), or IDEO.org fellows (who are designers that specifically work with IDEO.org). Non-IDEO members come from almost every continent and have occupations that range from directors and managers at non-profit organizations to freelance designers to design graduate students to Entrepreneurs/CEOs to development consultants. The common factor across most members is that their work focuses on development or social programs.

For (c), Table 1 lists all the nine possible focus areas, along with how frequently each area occurs in the cases. Focus areas are not mutually exclusive; a case study can include multiple focus areas.

For (d), we encode method occurrence in a 809×39 binary matrix, where each row is a case, each column is method, and a cell is one if that method was used in that case study and zero otherwise. The 39 methods are those used in IDEO's HCD Toolkit, and we provide a list of these methods in Tables 4–6. The purpose of this paper is answer four research questions regarding how designers use those 39 methods in design for development.

Before presenting the results, we review the different statistical analysis methods used to answer each of our four research questions:

# Cases	% Cases	Focus Area
506	62.5	Community Development
480	59.3	Agriculture
317	39.2	Education
281	34.7	Environment
225	27.8	Health
140	17.3	Water
124	15.3	Gender Equity
97	12.0	Energy
92	11.4	Financial Services

TABLE 1. Breakdown of the 809 cases by Focus Area. A case could have multiple focus areas.

1. **How does method usage vary across the entire case study corpus?** We take the binary matrix from (d) and use bootstrap resampling to construct 95% confidence intervals around the overall method usage proportions.
2. **Which methods complement one another?** We calculate Pearson product moment correlations between each of the 39 methods, resulting a 39×39 correlation matrix. The magnitudes of these correlations are then compared to determine which methods complement one another.
3. **Which methods are more or less useful for different kinds of development engineering problems?** We segment method usage across particular focus areas and then compare individual methods proportions within a focus area and outside a focus area. This is essentially a large-scale hypothesis testing problem with $9 \times 39 = 351$ statistical tests. We use a Normal Q-Q plot and a standard False-Discovery Rate Control algorithm [23] to deal with the effect of multiple comparisons and locate methods that occur significantly more frequently in particular kinds of problems.
4. **How does method usage compare between professional designers at IDEO and the rest of the HCD Connect community?** We compare method usage across organizational affiliation (IDEO vs. non-IDEO) by calculating 95% confidence intervals using bootstrap resampling.

For further details regarding our methods, you can go to our companion site[3] and download our experiment code to review or reproduce any of our below results.

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[3]http://www.markfuge.com/hcdconnect

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FIGURE 1. An example of an HCD case. Some common elements include: (a) A title and description discussing the problem and methods used, (b) information about the user submitting the case study, (c) a list of focus areas applicable to the case, and (d) a list of HCD Toolkit methods that the case used.

RESULTS

Our analysis of HCD Connect's user research methods contains four parts: describing general patterns of overall usage, finding methods that complement one another, inferring which methods are more frequently used for particular types of problems, and comparing patterns of method usage between IDEO and non-IDEO community members. In brief, for each part respectively, we find that: methods from earlier in the design process are more frequently used; that certain methods correlate well with others, primarily within design stages, and to a lesser extent across design stages; that a select few methods are significantly more common for certain types of development problems than they are in general; and that IDEO designers use fewer methods overall than non-IDEO counterparts and tend to focus on earlier design stages.

For our first question, "How does method usage vary across the entire case study corpus?", Figure 2 demonstrates the percent of cases that contain a particular method. From this, one can immediately discern the popularity of methods in the initial phase

of the HCD toolkit (Hear): members use many of these methods in up to one quarter to one third of all cases. As one moves later in the design process, method usage decreases.

Finding Complementary Methods

For our second question, "Which methods complement one another?", we compute the Pearson product-moment correlation coefficient between two methods across all cases; this correlation ranges between 1 (always used together) and -1 (never used together). Figure 3 visualizes these correlations by plotting the correlations as a matrix. Notably, we did not find any cases of strong negative correlation; methods were either positively correlated or uncorrelated. We group the rows and columns such that each design stage remains together, with the green, orange, and purple labels corresponding to the Hear, Create, and Deliver stages, respectively.

Figure 3 illuminates important features of how methods co-occur: the Create and Deliver methods have higher intra-stage correlations than they do across stages. This means that methods tend to co-occur with methods within their same stage. More interesting, however, is the tendency for Create methods to highly correlate with Deliver methods, while not as much with Hear methods.

To highlight which methods are most complementary to one another, Table 2 rank orders the top 20 method pairs by correlation coefficient—*i.e.*, they are the 20 methods most likely to co-occur together. (A full ranked list of all correlations can be downloaded from the paper's companion website.) This approach locates many pairs of methods one would expect to be complementary. For example, the methods Individual Interview, Group Interview, Expert Interview, Interview Guide, and Interview Techniques all highly correlate with one another—they all leverage a type of interviewing. Highly visual methods that involve drawing abstractions or clustering also highly correlate with each other: Create Framework, Diagrams, Storyboards, Find Themes, and Extract Key Insights. Methods concerned with assessing the end result of the process correlated together: Evaluate Outcomes, Track Indicators, Implementation Timeline, and The Learning Loop. Community-centered methods, such as Build on the Idea and Participatory Co-Design, correlate with one another. The vast majority of the top-ranked correlations have methods from the same design stage. This is expected, since methods from the same stage would have a higher likelihood of complementing one another, and gives us confidence in the utility of using method correlation coefficients to group complementary methods.

Differences in Method Usage Across Focus Areas

To answer our third research question, "Which methods are more or less useful for different kinds of development engineering problems?", we partitioned the case studies by focus area
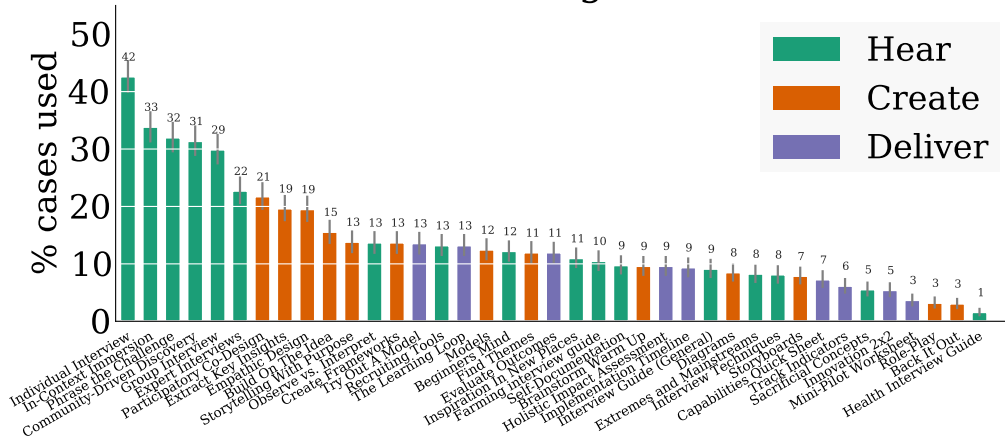
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FIGURE 2. Percent method usage by case. Overall, users use methods from earlier design stages more frequently.

(Table 1). We then computed independent sample t-statistics for each method's usage frequency in a focus area, compared with its usage frequency across all other focus areas. Testing all these combinations results in 351 different statistical comparisons, and Fig. 4 plots these t-statistics as a probability plot, where we see that most the comparisons result in no appreciable difference (the straight line). However, towards the right and left sides, a few comparisons stand out as unexpected.

Quantitatively, we account for these multiple comparisons by using the Benjamini-Hochberg (BH) procedure [23], assuming independent tests with a False Discovery Rate of 5%. The BH procedure is a Bonferroni-like post-hoc correction to the results of multiple statistical tests; its principle advantage being that it allows you to directly control the False Discovery Rate—essentially Type-I error, but across multiple tests. With this, we filter down the comparisons in Fig. 4 to the reduced list in Table 3. This table orders each method and focus area by the probability of the observed t-statistic, while also providing the percentage difference in frequency (%Δ—essentially the percentage effect size). A full list of all 351 tests is available on the paper's companion website.

Our results indicate that several methods had sizable differences in percent usage depending on the focus area: In Agriculture—Farming Interview Guide (+16%) and Try Out A Model (+11%); in Community Development—Participatory Co-Design (+15%) and Community-Driven Discovery (14%); and in Gender Equity—Group Interview (+17%). This provides a unique view of methods that illuminates meaningful differences depending on a problem's focus area.
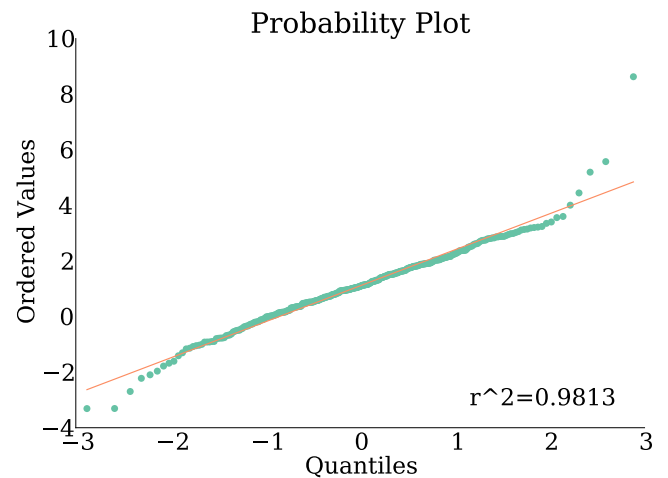

FIGURE 4. A Normal Probability plot for focus area method t-statistics. Most methods in each focus area are not appreciably difference from their usage overall; however, for select methods on the left and right hand side, their usage patterns differ from other focus areas. Table 3 lists the methods whose usage differs across particular focus areas.

Differences Between IDEO and non-IDEO users

For our last question, "How does method usage compare between professional designers at IDEO and the rest of the HCD Connect community?", we compare the method usage behavior between IDEO and non-IDEO affiliated users. We chose this affiliation as a proxy for a particular design culture, since we could not find a straightforward way to separate out professional de-
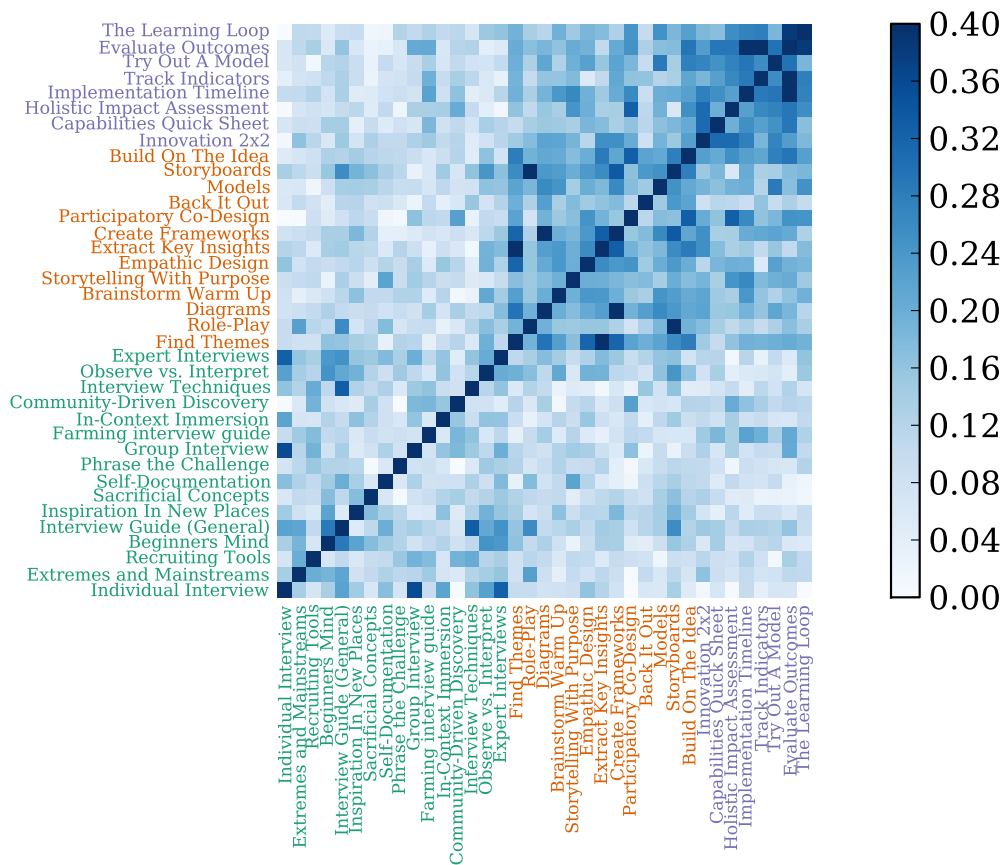
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FIGURE 3. Certain methods more positively correlate with other methods, however there is almost no negative correlation between methods. The shaded boxes indicate the correlation coefficient between methods—darker indicates increasing positive correlation. We threshold the diagonal to 0.4 for clarity of presentation, since it always has correlation of one. We see that methods from later stages (Create and Deliver) have higher correlation within each category, as well as across categories. "Hear," "Create," and "Deliver" methods are labeled using green, orange, and purple, respectively.

signers and non-professional designers from the non-IDEO user pool. Regardless, since IDEO itself released the HCD Toolkit we still believe that the comparison is worthwhile.

Figure 5 demonstrates the differences in how IDEO and non-IDEO members report methods. In the IDEO case, the designers place heavy emphasis on earlier stage (Hear) methods, with method usage dropping off rapidly in later stages. Moreover, those designers do not report many case studies where they used methods from multiple stages (*e.g.*, Hear+Connect). This is in part due to the low percentages of Create or Deliver methods in general, but also could be due to different reporting styles—IDEO designers could systematically split their cases into multiple case studies over different stages, rather than a single case.

Comparing individual methods, Fig. 6 confirms Fig. 5: IDEO users use less methods overall, but have a much higher percentage usage in the initial Hear stage, rather than in the Create or Delivery stage. In addition, Fig. 6 demonstrates that IDEO designers prefer certain types of methods for each phase, compared to non-IDEO designers who use more of mix—for example, IDEO designers appear to prefer methods that involve data interpretation, such as extracting insights and themes, building frameworks and models, *etc.* (we note that many of those methods complement each other as per Table 2).

DESIGN IMPLICATIONS

Our findings have several implications on the application of design thinking and user research to design for development projects: focus on earlier stage design methods, determine whether your particular problem requires a specific type of method before diving in, and equip yourself with complementary
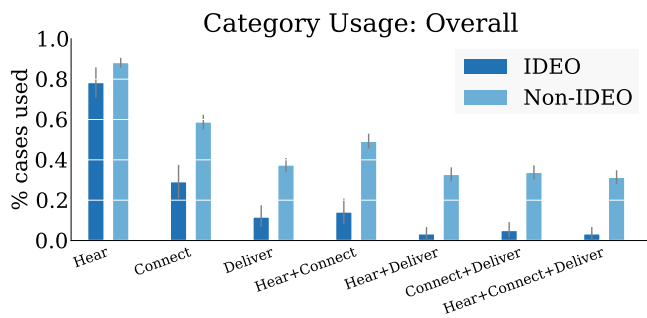
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FIGURE 5. Method usage grouped by organizational affiliation. Combined columns, such as "Hear+Create," indicate cases where at least one method from each category was used in the case. IDEO members contribute case studies that typically focus on the first design stage ("Hear"), and rarely submit cases that combine methods across different design stages. In contrast, non-IDEO members contribute cases that use a more even distribution of methods from different design stages, and typically combine methods from different stages in a single case-study.
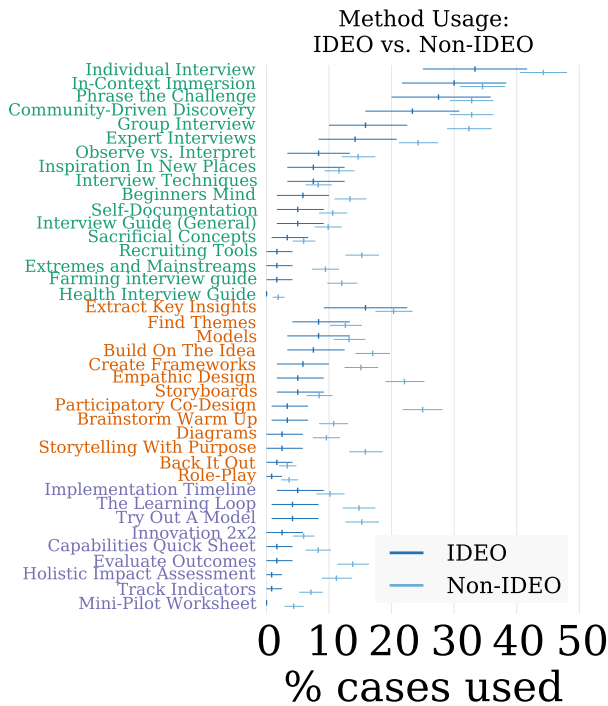

FIGURE 6. Differences in particular method usage between IDEO and non-IDEO members. The methods are grouped by green, orange, and purple for "Hear," "Create," and "Deliver" respectively. As noted in Fig. 5, IDEO members tend to use less methods per case overall, and particularly focus on the first design stage (Hear).

Corr.	Method 1	Method 2
0.46	(D) Evaluate Outcomes	(D) Track Indicators
0.42	(C) Find Themes	(C) Extract Key Insig
0.41	(C) Storyboards	(C) Role-Play
0.41	(C) Create Frameworks	(C) Diagrams
0.40	(D) Evaluate Outcomes	(D) Implementation Ti
0.38	(D) The Learning Loop	(D) Evaluate Outcomes
0.36	(H) Individual Interv	(H) Group Interview
0.34	(C) Create Frameworks	(C) Storyboards
0.33	(H) Interview Techniq	(H) Interview Guide
0.33	(C) Create Frameworks	(C) Extract Key Insig
0.33	(C) Build On The Idea	(C) Participatory Co-
0.33	(H) Individual Interv	(H) Expert Interviews
0.33	(C) Participatory Co-	(D) Holistic Impact A
0.32	(C) Find Themes	(C) Create Frameworks
0.32	(C) Find Themes	(C) Empathic Design
0.31	(D) Capabilities Quic	(D) Innovation 2x2
0.31	(D) Innovation 2x2	(D) Holistic Impact A
0.30	(D) Try Out A Model	(D) Evaluate Outcomes
0.30	(C) Find Themes	(C) Diagrams
0.29	(C) Build On The Idea	(D) Evaluate Outcomes

TABLE 2. The 20 highest correlated methods from Fig. 3; these methods likely complement each other. The method's design stage within the HCD Connect toolkit is shown in parentheses ('H,' 'C,' or 'D' for "Hear," "Create," and "Deliver," respectively.

methods.

As Figs. 2, 5, and 6 demonstrate, members on HCD Connect use a higher percentage of earlier stage design methods. Part of this reason could be that IDEO's culture or the particular structure of their toolkit creates an unstated preference or emphasis on earlier stage methods, or possibly that members selectively report cases they believe would fit that culture. That said, one outcome remains clear: an integral part of almost all cases involved using methods that allow you to understand the community you are designing for. Regardless of its cause, we view this Human-Centered Design tenant as being particularly critical for developing world contexts, where the end-user's experience of your product or service will often be substantially different that your own. We are currently investigating broader classes of methods

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Prob.	% Δ	Method	Focus Area
5.8e-17	15.7	Farming Interview Gu	Agriculture
3.4e-08	15.3	Participatory Co-Des	Community Devel
2.6e-07	11.6	Try Out A Model	Agriculture
1.0e-05	14.3	Community-Driven Dis	Community Devel
6.8e-05	4.7	Mini-Pilot Worksheet	Agriculture
3.6e-04	8.7	Holistic Impact Asse	Environment
4.9e-04	17.1	Group Interview	Gender Equity
7.2e-04	8.9	Storytelling With Pu	Education
8.4e-04	5.3	Track Indicators	Agriculture
1.1e-03	-11.1	Expert Interviews	Water
1.1e-03	-14.4	Individual Interview	Water
1.3e-03	8.0	Build On The Idea	Community Devel
1.5e-03	7.9	Farming Interview Gu	Environment
1.6e-03	13.2	Storytelling With Pu	Gender Equity
1.7e-03	15.3	Community-Driven Dis	Gender Equity
1.8e-03	7.4	Storytelling With Pu	Community Devel
2.1e-03	4.5	Health Interview Gui	Health
2.1e-03	17.3	Community-Driven Dis	Financial Servi
2.3e-03	4.6	Innovation 2X2	Agriculture
2.6e-03	7.8	Evaluate Outcomes	Environment
2.9e-03	5.9	Holistic Impact Asse	Community Devel

TABLE 3. Methods whose usage in a given Focus Area is significantly different from all other Focus Areas. The first column lists the probability of the observed t-statistic, the second lists the difference between the usage percentage of that method in that focus area with respect to other focus areas, the third column lists the method, and the forth the particular focus area in which we found the method usage to be different. We selected these methods from those in Fig. 4 using the Benjamini-Hochberg procedure at a False Discovery Rate (FDR) of 5% assuming independent or positively correlated tests.

and cases from outside HCD Connect to examine this pattern of usage.

Figure 4 and Table 3 demonstrated that certain methods work well in particular problem types; the difficult piece being how to identify those particular cases. We proposed a approach based on multiple comparison testing with False Discovery Rate Control procedures, though other options exist for possible future research directions. Part of the difficulty lies in determin-

ing an appropriate minimum effect size: is a 17% increase in a method's usage important enough? At what threshold is a focus area's effect on a method too large to ignore? We also note that many methods *did not* differ among problem types—this points to a dichotomy between general-purpose methods and problem specific methods. Some research has begun to map out these differences [22], but more in-depth quantitative and qualitative work is needed.

Lastly, in Fig. 3 and Table 2, we see that all methods are not independent from one another. Understanding how methods relate to one another, whether by automatic means (such as correlation coefficients) or through qualitative study, would allow one to make more strategic method choices. For example, if you know that Storyboards better complement Role-Play over Group Interviews you can make smarter user research choices and trade off breath for depth.

The results we present here apply to design for development projects using user research methods, however a natural question arises: to what extent do these results extend to other types of projects or methods? Comparisons with methods and cases from a broader set of design areas are a necessary next area of research, and researchers are presently collecting such databases that would allow for such comparisons [22, 21]. Once collected, the techniques we use to analyze user research methods in this paper could also be used to analyze usage in a broader class of methods. In non-development projects, we expect that user research methods would also focus on earlier stages of design and that correlations such as those in Tables 2 and 3 would not differ drastically, however we would need to collect more usage data from a variety of domains to make that claim.

CONCLUSIONS

This paper presents an analysis of how designers employ user research methods in developing world contexts. Specifically, we focus on the HCD Toolkit—a set of methods used by IDEO.org—and look at how those methods are used across a variety of factors: what stage of design is most frequent; what methods are commonly used together; what methods are specifically used for certain types of problems (Agriculture, Health, *etc.*); and how does method usage differ across affiliations (IDEO versus non-IDEO).

We found that method usage varied markedly, with earlier stage methods being substantially more frequent, particularly for IDEO designers. We identified certain methods that complement each other, as well as methods that designers commonly use for particular kinds of problems. Professional designers at IDEO utilize less methods per case and focus primarily on earlier design methods that focus on data gathering; it is unclear how much of that trend comes from selection bias in reporting, the culture of our particular sample, or designers' genuinely emphasizing those types of the design methods.

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Beyond quantitative analysis, future work could address several complementary qualitative questions. Further content analysis of the case studies themselves could elaborate why those methods were chosen, along with what worked well or poorly. Another helpful next step would be to establish a better qualitative understanding about why certain methods were chosen for particular types of problems (*e.g.*, Farming Interview Guide for Agriculture versus Participatory Co-Design for Community Development). In the same vein, exploring how IDEO or non-IDEO designers choose the methods they use, given the problem context, would enlighten many aspects of this paper. Part of our future work includes using a wider set of methods and cases from theDesignExchange [22, 21] to broaden our analysis outside of design for development methods.

With both a quantitative and qualitative picture of how user research methods are applied in design for development projects, one can be better equipped to make the right resource decisions when embarking on design for development projects, allowing us to create better products and services by making sure that our designs address the correct user needs.

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Method Name	Method Description
Beginners Mind	When entering a familiar environment, strive to leave behind assumptions based on your prior experience and cultivate Beginners Mind. Ask questions you think you might already know the answer to you may be surprised by the answer. We all interpret the world based on our experience and what we think we know. This lens of personal experience can influence what you focus on and can make you unable to see important issues.
Community-Driven Discovery	Consider recruiting members of the community to be the primary researchers, translators, designers or key informants for your project. By asking respected community members to lead the research, your team will gain expertise, insight and perspective. The involvement of community members with strong relationships or a reputation for intelligence and fairness may help other participants to express their concerns openly and honestly. These research partners can also help interpret the meaning and motivations behind the statements of other participants.
Expert Interviews	If you need lots of in-depth or technical information in a short period of time, consider engaging an expert to supplement your primary research. Others may have already done research relevant to your project. Experts can help you to learn about the history and context of a particular community or topic, understand the regulations that might affect design and implementation of solutions, or provide you with information about new or developing technologies.
Extremes and Mainstreams	When recruiting participants, try to include opposite extremes and the mainstream in between, in order to hear a full range of behaviors, beliefs and perspectives. A good balance includes equal numbers of three types of participants. One-third of participants might be the extreme who are successful, adopt new technologies quickly and exhibit desirable behaviors. One third may be the opposite extreme, those who are very poor, resistant to new technologies or exhibit problematic behaviors. The final third represents the mainstream in the middle.
Farming interview guide	Structure the interview so participants feel comfortable discussing personal, family and community farming issues as well as and innovation challenges such as attitudes toward credit and risk. The conversation will progress from specifics, to broad aspirational thinking and then to challenging What if? scenarios. Create thoughtful interview questions and sequence them logically to help you engage participants in conversation while staying focused on a particular research topic.
Group Interview	A Group Interview is a good way to learn about community life and dynamics and to understand community issues quickly. It is a valuable method for giving everyone in the community a chance to voice their views. You wont gain a deep understanding of individual needs and beliefs in a Group Interview, so look to Individual Interviews to accomplish this.
Health Interview Guide	Structure the interview so participants feel comfortable discussing personal, family and community health issues as well as innovation challenges such as vaccines or doctor visits. The conversation will progress from specifics, to broad aspirational thinking and then to challenging What if? scenarios. Create thoughtful interview questions and sequence them logically to help you engage participants in conversation while staying focused on a particular research topic.
In-Context Immersion	Meeting people where they live, work and socialize provides new insights and unexpected opportunities. By being with people in their real settings and doing the things they normally do, you can talk to them about their experiences in the moment. By immersing yourself in their context, youll gain empathy and come to understand the people you are designing for on an intellectual and experiential level. This understanding will help you to design solutions with their perspective in mind.
Individual Interview	An Individual Interview can provide a deep, rich view into a persons behavior, reasoning and life. When possible, conduct interviews at the participants home or workplace. These in-context individual interviews put the participant at ease and allow you to see the objects, spaces and people that they talk about during the interview.
Inspiration In New Places	To get a fresh perspective on your research, shift your focus. Explore experiences similar to your own, but in a different context or topic area. How do you find inspiration in new places? A surgeon might get insights about organizing their medical supplies by visiting a hardware store, or an airline employee might get ideas about check-in by observing a hotel front desk or a water-jug creator could observe other ways individuals transport heavy objects or liquids.
Interview Guide (General)	An Interview Guide will help you to structure the interview so participants feel comfortable as the discussion progresses. Interviews should be able to flow from day-to-day specifics, to broad aspirational thinking and then to challenging What if? scenarios. Create thoughtful interview questions and sequence them logically to help you engage participants in conversation while staying focused on a particular research topic.
Interview Techniques	You can collect rich stories by expanding your interview approach and techniques. Consider asking participants to show, draw, describe their thought process or reflect on why they have specific behaviors or attitudes. Through telling stories, people reveal important issues and opportunities in their daily experiences. Often, what people say they do and what they actually do are not the same thing. These techniques can supplement straightforward questions in an interview.
Observe vs. Interpret	Identify and set aside your personal biases. Developing an unbiased understanding of peoples behavior and motivations enables you to design the products, services or experiences that they genuinely need. This exercise will help you and your team practice differentiating between observation and interpretation of what you see. Youll describe what you see, consider multiple possible interpretations and list the questions you would ask to find the correct answer.
Phrase the Challenge	You can use this method to identify criteria, establish a point of view and write an appropriate Design Challenge. Your challenge will guide the questions you ask in the field and the solutions you develop later in the process. A good challenge is framed in human terms (rather than technology, product, or service functionality), with a sense of possibility. It is both broad enough to allow you to discover areas of unexpected value and narrow enough to make the topic manageable.
Recruiting Tools	Recruiting the right participants is important to the success of your project. Identify questions to ask to help you find a broad range of participants. Work to find people who represent a balance of gender, ethnicity and class as well as a full range of behaviors, beliefs and perspectives. Keep track of the people you have spoken with and those you plan to speak with. It is helpful to record information about the types of participants and the characteristics of groups and locations.
Sacrificial Concepts	Sacrificial Concepts are ideas or solutions created to help make hypothetical or abstract questions accessible. These concepts dont have to be feasible. They serve the purpose of sparking conversation, challenging assumptions and helping people understand an issue. Abstract questions about how something could be different are often difficult to answer. Sacrificial Concepts provide concrete scenarios that people can respond to.
Self-Documentation	This powerful, long-term method engages participants in recording their own experiences and can help your team to understand the nuances of community life. When you cant be present, participants pictures and journal entries reveal how they see their life, community and relationships.

TABLE 4.   The "Hear" methods from IDEO's HCD Toolkit.

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Method Name	Method Description
Back It Out	Once youve identified themes and patterns, youll want to rearticulate the problems or needs into opportunity areas. Now is not the time for solutions. So, if your opportunity sounds like a specific solution, step back and look at the original insight. Ask yourself, Why offer the solution? Work with your team to restate the insight, identify the needs that youve answered with your solution, and then rephrase the opportunity.
Brainstorm Warm Up	Brainstorming new solutions involves opening your mind and generating lots of wild impractical solutions in order to come up with a few reasonable ideas. It is often challenging to defer judgment and encourage wild ideas. Get your team in an energetic and open mindset for brainstorming by practicing what a successful experience feels like.
Build On The Idea	Bring your solutions to people in the community to re-engage them in the design process and gather honest feedback. Listen to their questions and suggestions and be willing to adapt, improve and rethink the idea. Invite participants to build on the ideas you present and ask them to consider how the solutions could be better for them.
Create Frameworks	A framework is a visual representation of a system that illustrates elements and relationships. When you create a framework, you put the specific information you have gathered from stories into an easily visualized system. This helps you to contextualize information and see the issues and relationships in a clear, holistic way. You can use the framework as a tool for discussion and as a means to develop or build upon key insights. Not all Design Challenges will yield or require frameworks.
Diagrams	A Diagram is a form of prototype. Prototypes are disposable tools that help you to think, communicate with others, validate ideas and generate more ideas. By prototyping your ideas youll develop a deeper understanding of what the idea means and youll uncover questions about its desirability, usability, viability and feasibility. Creating Diagrams is a great way to express a space, process, or structure. Use this visual tool to map out and consider how ideas relate to one another and how processes or experiences change over time.
Empathic Design	This approach to problem solving begins with peoples thoughts and feelings. Your design team will work to develop empathy and connect emotionally with the people you are designing for, in order to understand the problems and realities of their lives. Ideally, your team will do research across many different groups of people and walk in their shoes before trying this method.
Extract Key Insights	Dig into your research and youll be surprised to uncovering hidden meanings. Insights are revelations, the unexpected things that bringing visibility and clarity to your research. As you extract key insights youll turn individual stories into overarching truths and youll come to see your Design Challenge in new ways.
Find Themes	Finding themes is about exploring the commonalities, differences, and relationships between the information youve gathered, in order to find meaning. Begin by grouping data and sorting your findings into categories or buckets. Cluster related ideas into themes. Consider the relationship between them and look for patterns. You can group and re-group the data in different ways to help you identify opportunities.
Models	A Model is a form of prototype. Prototypes are disposable tools that help you to think, communicate with others, validate ideas and generate more ideas. By prototyping your ideas youll develop a deeper understanding of what the idea means and youll uncover questions about its desirability, usability, viability and feasibility. A physical model of a product, quickly mocked up using rough materials, is a simple means of prototyping that allows you to consider your ideas in 3-dimensions.
Participatory Co-Design	Having your team co-design solutions with people from the community is a great way to leverage local knowledge. It can also lead to context appropriate solutions that are likely to be adopted, since local people have invested resources in their creation. Consider using participatory co-design when a lot of local knowledge and expertise are needed, solutions from the outside will not be easily adopted or the politics of a community require it.
Role-Play	Role-playing is a form of prototype. Prototypes are disposable tools that help you to think, communicate with others, validate ideas and generate more ideas. By prototyping your ideas youll develop a deeper understanding of what the idea means and youll uncover questions about its desirability, usability, viability and feasibility. You can gain perspective and understanding of the emotional experience with a product or service by taking on the role of a person you are designing for and acting out the experience with team members.
Storyboards	A Storyboard is a form of prototype. Prototypes are disposable tools that help you to think, communicate with others, validate ideas and generate more ideas. By prototyping your ideas youll develop a deeper understanding of what the idea means and youll uncover questions about its desirability, usability, viability and feasibility. A storyboard of a product or service is a simple means of prototyping that allows you to imagine the complete story of a users experience through a series of images or sketches.
Storytelling With Purpose	When you tell a story, you transform what you heard during research into data and information that your team can use to imagine opportunities and solutions. One team members specific, descriptive and timely story can become shared knowledge and provide inspiration to the whole team. Because stories are accounts of real people, real situations and specific events (not general statements or summaries) they provide concrete details that help you address particular problems.

TABLE 5. The "Create" methods from IDEO's HCD Toolkit.

Method Name	Method Description
Capabilities Quick Sheet	To make a solution feasible you'll need to think about where and how your solution will be used or experienced. Consider the capabilities of your organization and who you can partner with to enhance those capabilities. Answer the questions on this Capabilities Quick Sheet to help you identify the range of human, technological, financial and distribution capabilities needed to make your solutions real.
Evaluate Outcomes	Evaluating outcomes is important to the learning cycle. Measure, assess and evaluate the impact of your solutions in order to learn, plan, iterate and create new design challenges. A good assessment of a solution provides an opportunity for reflection that will inform the direction and goals for the next round of designs. Measurement also helps stakeholders understand where to best invest their resources and how to plan for the future.
Holistic Impact Assessment	When assessing the impact of solutions, take a systemic and holistic view. Identify all the stakeholders and the effects of your solutions. Create a map correlating the stakeholders to the effects. Then, keep iterating to increase positive and decrease negative effects.
Implementation Timeline	After trying the Innovation 2x2 method, plot your findings into an implementation timeline for your organization. Typically, innovations in the incremental category belong early in the timeline and revolutionary innovations further out. Look at relationships of solutions to see whether initiating one solution will build the relationships and partners needed for another solution. Consider which solutions are within the scope of currently funded programs. Assign owners to pursue next steps for each solution.
Innovation 2x2	What type of innovation is right for your project? To understand how new solutions will work within your organization; map them across an axis of new-to-existing users and new-to-existing offerings. This exercise will help you identify whether your solutions are revolutionary, evolutionary or incremental. Knowing whether your solutions extend, adapt or create a new offering helps when considering them in the context of your investment strategy, mission, priorities and appetite for risk. Youll also clarify whether your solution is targeted at your current user group or whether it expands the group of users.
Mini-Pilot Worksheet	Plan to collect on-going feedback and continually iterate on ideas. Before full-scale implementation, you can use the Mini-Pilot worksheet to plan next steps and continued iterations for each solution. Use the worksheet to help you track progress, measure success and evaluate outcomes.
The Learning Loop	Throughout the design and implementation of new solutions, it is important to keep listening, learning, evaluating and iterating. Stories, feedback, indicators and outcomes are ways of gathering data you can use in a continuous learning cycle. Early in the design process, you collected stories that helped you develop new ideas. After the first ideas were prototyped, you gathered feedback to make those ideas better. As implementation begins, continue to collect stories and gather feedback from users. Track progress and measure the outcomes of your solutions in order to keep improving your designs.
Track Indicators	Indicators help you measure the effects and effectiveness of your solutions. These effects can be positive or negative. They can also be intended or unintended. Some types of indicators include:leading(early information you can use when outcomes wont be clear for a long time),engagement(the number of people engaged in a new program) oranalogous(where direct impacts are difficult to see). Work to identify and track indicators appropriate to your project.
Try Out A Model	For a solution to succeed, youll need to design a sustainable revenue stream. There are several fee models your team can try out to see if your ideas are viable. Consider what a solution might look like if it were offered in a variety of different ways, such as by subscription, subsidy or pay-per-use.

TABLE 6. The "Deliver" methods from IDEO's HCD Toolkit.

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