Agile Corps - A Public Service-Learning Program: Design Research

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***Abstract* - Each year, the U.S. government invests more than \$86 billion on IT products and services while the majority of these projects fail--they are delivered late, go over budget, are canceled, are outdated if delivered, or are not user-friendly. Due to barriers in hiring and training, the government tends to outsource IT talent at a premium through contractors, but the results have not changed. The small amount of talent that exists in government tends to be senior, and there currently are very few, viable options for high-quality, junior and mid-level technologists to find a job in government and develop. To design a solution, we use a Design-based Implementation Research methodology which includes jointly negotiated work, iterative and collaborative design processes, development of theories, and design for viability. Agile Corps is a program designed to identify, recruit, train, and retain junior and mid-level technology talent in the government. Agile Corps exemplifies public service-learning, a learning approach and strategy that combines learning objectives, instruction, and reflection with government service on behalf of the public. This paper presents the design research and initial prototypes of the program and service called Agile Corps and introduces and prototypes the concept of public service-learning.**

Index Terms - Agile Corps, public-service learning, Human-centered Design, digital services

INTRODUCTION

Each year the U.S. government invests more than \$86 billion on IT products and services, yet this does not usually yield solutions that meet the needs of the users of those products and services¹⁻². In fact, 94% of those IT project fail, according to the Deputy Director of the US Digital Services (USDS), Haley van Dyck. “The status quo is failure.¹” Failure includes a project that is late, over-budget, canceled, or, if delivered, ill-fitting to the user, or outdated.

One approach to addressing the problem is by changing the culture around software engineering in the government, including a shift to more innovative development methodologies. The White House even published a report encouraging innovation and Agile methodologies in government technology work³. Others want to address the problem from the human resource perspective; however most of the software engineering work is done by contractors outside the government⁴⁻⁵. While trying to address this problem, federal government agencies find it difficult to hire quality technology talent, creating a void of skilled people who can implement technology solutions within the government⁶⁻⁷. Additionally, agencies struggle or fail to train their existing employees on modern digital practices, which often results in training dollars going unused.

Outside the government, individuals with technology talent have a desire to work for the federal government, but encounter roadblocks when trying to find a job in the government due to complex hiring processes.

A public civic consultancy named [18F](#), the [PIF](#), and [USDS](#) are organizations that represent one model for a solution⁸⁻¹⁰. They have attempted to address this problem by hiring senior designers and developers from companies like Amazon and Google, but the government ultimately lacks a way to turn skilled junior and mid-level talent into the skilled senior workers that can help transform the government digital portfolio. How might we increase the number of skilled candidates at all levels who use modern digital practices such as Lean Startup, Human-centered Design (HCD), and Agile mindsets to improve the outcome of government products and services? When hired, how do we keep such workers in government providing them with a pathway for development and growth? These were the questions that fueled the authors to design a new program called Agile Corps.

In order to quickly develop individuals into greater talent that can impact government, Agile Corps was researched, conceptualized, and designed by 18F to find, recruit, hire, train, and retain both existing federal employees and external talent with a digital background, by creating a hands-on, experiential, developmental program that enhances the knowledge and skills of participants. Because Agile Corps allows candidates to work on real-world challenges in service of the US public including citizens, refugees, and immigrants, we define a new term called public service-learning. Public service-learning (PSL) is a learning approach and strategy that combines learning objectives, instruction, and reflection with, specifically, public or government service on behalf of the public. In PSL, there is an equally mixed purpose of the growth and development of the learner as well as positive outcomes or benefits for citizens, immigrants, and refugees--strengthened public communities. Because service-learning is defined as “a form of experiential education in which students engage in activities that address human and community needs together with structured opportunities for reflection designed to achieve desired learning outcomes,” PSL is a form of service-learning¹¹. Moreover, whether Agile Corps will have specific elements such as courses or credit-bearing depends on the research that is uncovered, the design, testing results, and iteration. Since it is experiential education to address community needs while including reflection, it falls under service-learning.

Though we had many questions to answer in designing Agile Corps, the main challenge was to answer our framing questions.

1. How might we increase the number of skilled candidates at all levels who use modern digital practices such as Lean Startup, Human-centered Design, and Agile mindsets to improve the outcome of government products and services?
2. When hired, how do we keep such workers in government providing them with a pathway for development and growth?

METHODOLOGY

The most important factors in determining which research methodology to use are the research questions¹². Because our research questions are open-ended, lack a specific hypothesis, and seek to uncover the mindsets, fears, and difficulties of public servants in government institutions, a qualitative research methodology is best.

However, the answers to the questions will be used in an initial design. Since both questions are used to design an educational program intervention used to improve government products and services for the public, we also need a design experiment or design-based research methodology. Design-based research (DBR) is characterized by pragmatism, theory, iterations, integration, and contextualization¹³⁻¹⁴.

Because DBR often is initiated by the educational researchers as opposed to practitioners and may never be implemented in an actual learning environment, we employ a more narrow version of DBR called Design-based Implementation Research. Design-based Implementation Research (DBIR) has 4 guiding principles. These include jointly negotiated work, iterative and collaborative design processes, development of theories, and design for viability¹⁵⁻²¹. Following those principles, this work was initiated and requested by different government agencies, 18F, and technologists who find it difficult to be hired by the government. Our design team includes government workers as well as the potential students. Theories guide and emerge from our design research and work. Finally, our goal is sustainability via career development and growth potential for junior and mid-level technologists brought into government service.

Design-based Research, in general, does not have to use a mixed methodology, though sometimes it does. In this case, we are combining DBIR with a qualitative methodology; therefore we chose the mixed methodology called Human-centered design (HCD, user-centered design, or design thinking) as our overarching framework because it combines a qualitative methodology with DBIR²²⁻²⁵. In education, HCD is often called student-centered design or learner-centered design (LCD). Human-centered design is only a methodology, not a solution. It can be used to design a building, a project, software, a process, a service, a product, an environment, a program, an organization, or even a curriculum. Human-centered design mixes skills from engineering design such as defining the problem, setting the constraints, and rapid prototyping with practices from the social sciences such as ethnographic studies, interviews, extracting insights from qualitative data, and empathic immersion²⁶⁻²⁹. In short, human-centered design keeps the design work centered on the users, the beneficiaries, or the community. In this work, HCD creates two pillars. First, instead of the traditional model where the designers go away, design a solution, and then bring it back to the community, in HCD, we practice participatory co-design where the community is involved in every stage of the design process³⁰⁻³². Second, instead of the design team only including members from outside the community, the design team also includes federal government workers who lack the ability to hire the talent.

In this work, the design team includes 4 government workers. Second, we involved not only local design team members but also technologists outside of government in every stage of the work.

Human-centered design is normally broken into three stages, Discover, Design, and Deliver. The first stage (Discover) is a research stage where you listen and learn from the community for whom and with whom you are designing, developing empathy and connecting yourself to the needs and desires of that community. The second stage (Design) is a stage of data analysis and synthesis of the previous qualitative and quantitative work, followed by ideation, prototyping, feedback, refinement, and iteration. The final stage (Deliver) is the stage of pilot planning, developing a feedback loop, defining success, partnerships, and developing business models for financial viability and sustainability.

The remainder of the paper is broken into two remaining main sections. First we provide a brief overview of the procedures and methods used in the first half of the HCD process (Discover and first half of the Design stage). Then we provide the results of the synthesis process: themes, insights, frameworks, and learning theories. All of this will inform the iterative process and initial pilot to be presented in a future paper.

DISCOVER

Define the Challenge

The team convened to first define the design challenge, constraints and preferences.

Create a cost-recoverable way to increase the number of US-citizen, junior and mid-level IT candidates hired into the US federal government and create a supportive environment conducive for the professional growth of Agile & HCD-trained junior and mid-level IT employees in the US federal government.

- **Constraints**
 - cost-recoverable
 - US citizenship
 - HCD
 - Agile methodology
 - Iterative delivery (implied in HCD and Agile)
- **Preferences**
 - with 1:1 mentorship
 - < 5 hours per week with mentor
 - around a year total program time
 - college degrees not required
 - way or place for Agile Corps learners to build a portfolio and learn HCD and Agile
 - increase the general gender and ethnic diversity of IT professionals in the government

The constraints, built into the design challenge, are characteristics of the solution that are required for it to work. The preferences are desired characteristics of the solution without which, the solution still works.

Recognize Existing Knowledge

Then the team conducted a knowledge inventory, a method that elicits what team members know (known knowns) about learner needs, what technology can help, what solutions have been tried in other areas, and early hypotheses that various team members hold about what will solve the problem. The method also elicits what team members still need to learn (known unknowns) about what people do, think, and feel; how people value different offerings; what future needs people

may have; and the various challenges to the implementation of any ideas or solutions. The resulting information is taken to highlight strengths, weaknesses, and tensions among the group in order to direct our research towards our weaknesses and tensions and focus on what we need to learn.

- **Tensions that emerged**
 - Where the problem lies
 - recruitment
 - training & equipping
 - retention
 - Users not at the table
 - Agencies and their input
 - 18F leadership
 - Confusion about current 18F Educational work
- **Strongest team knowledge**
 - Other solutions or ideas are being tried in other areas
- **Weakest team knowledge**
 - Needs of Agencies
 - Scale and scope of problem
 - Who sees and feels the problem?
 - Scope of challenges
 - Intentions and expectations of 18F management

The exercise also elicits early hypotheses, or in this case learning theories, about the solution. Such learning theories do not refer to overarching theories such as constructionism or experiential learning, but rather smaller learning theories dealing with the specific context of the educational intervention³³. The initial thoughts of the design team were driven by three theories about a potential Agile Corps.

First, the learning team agreed that the educational program should heavily involve problem-based learning (PBL)³⁴⁻³⁷. Problem-based learning is a type of inquiry-based model of learning in which learners work collaboratively to solve complex, real-world problems through which they not only acquire and develop knowledge but also skills and attitudes. It involves self-directed, open-ended learning in which teachers serve in the role of facilitators³⁶. Adhering to the best research in andragogy (adult learning theory), the design team wanted to ensure that the skills gained were situated in the contexts of the public service work the learners would be doing³⁸⁻³⁹. Otherwise, a skill learned in one context may not necessarily transfer to a second context, and can actually be considered a different skill due to the different context, according to situated learning theory^{40,41}. Our theory was that the learners in Agile Corps must learn technology skills in the context of public service projects and work that requires those skills.

Second, the learning team felt that learning would be maximized if each learner had at least one mentor to ask questions and receive help when needed. The mentor can act in the role of a tutor which has been shown to increase learning mastery⁴². The mentor also can act in the role of a facilitator in the context of PBL when the sessions with the teacher are not occurring⁴³.

Third, the design team preferred a multi-month or long-term program not just to allow sufficient time for repeated application, mastery, and retention, but also to spread out the learning. Instead

of concentrating abstract learning with application much later in an indefinite future, the design team preferred that learners learn only what they need when they needed it. This type of just-in-time learning allows the PSL and PBL challenges and environments to dictate what learners needed to learn, in context and in the moment⁴⁴⁻⁴⁵. Just-in-time learning would increase retention rather than overloading students with too much knowledge and no application time.

Additionally, there are a number of other implicit theories around optimal program design. Before initiating this design research, the idea of the design team was to create an educational, PSL program that was based in Washington, DC for external participants who want to transition into government. The participants would study one of two larger tracks - software engineering (front-end, back-end, and full-stack development) or user experience (UX) design. Lastly the participants would learn in the Agile Corps training program for roughly 12-15 months, full-time with full days devoted to learning and practicing.

Define the Audience

The team then decided that the research should not only focus on potential learners, but also the agencies who would host the learners or allow employees to participate. It should also include 18F leadership who would sponsor the design of the program and could decide whether or not the design work being done by 18F staff needed to be cost-recoverable. It should also uncover current 18F education work to see if it could be leveraged or used as part of the PSL program. Lastly 18F would also be the source of mentors so 18F staff should be interviewed as well.

Using this information, the team defined the audience in three parts. First, the PSL program needs federal government agency partners who would agree to host the learners. Secondly the PSL program needs actual junior and mid-level IT talent to participate in the program. Finally, the PSL program needs current government technologists to serve as mentors. The definition criteria used for each of the three groups can be found in Table I.

TABLE I
AUDIENCE DEFINITION

Audience	Criteria
Agency Partner	US federal department, agency, or administration
	At least one Executive sponsor (CEO, CIO, Director of Design/Communications/Marketing, Director of IT, etc.) wanting to expand their internal talent pool to creates digital services
	Willing to create a pathway for participants to work using Agile development and HCD methodology during and after the program
	Availability of SMART ⁴⁶ projects <ul style="list-style-type: none"> critical, but low profile (no near-term White House initiatives) properly scoped (clearly defined problem statement)

	<ul style="list-style-type: none"> • set deadline within a program timeline (1-2 years tbd) • measurable milestones in multiple phases • definable success metrics • ability to interact with end users and work with agency stakeholders who are close to the problem • could be pilot project that is live for early feedback
Junior or Mid-level IT Talent	Can be from anywhere outside federal government
	Demonstrated interest <ul style="list-style-type: none"> • front-end development • back-end development • infrastructure • design
	Demonstrated career interest <ul style="list-style-type: none"> • front-end development • back-end development • infrastructure • design
	Demonstrated skill in at least one area <ul style="list-style-type: none"> • front-end development • back-end development • infrastructure • design
	Comfortable with a set GS-level ⁴⁷ (applicable for those recruited from outside government)
Mentors	According to this prototyped position description

Choose Research Methods

All the following research methods were chosen and later employed.

- Individual interview - an interview with only one interviewed person
- Group interview - an interview in which questions are posted to a group and group members take turn individually answering
- Expert interview - an interview with someone who has a relevant expertise, in this case, technology, digital literacy, product management, design, mentoring, education, etc.
- Observation - a period of watching and documenting learners or users or programs in their natural environment without interpreting what is happening

- Analogous inspiration - observation of a different context (of a mentoring program or training program) in order gain insight about designing something similar in your own context
- Community-driven discovery - co-participatory research in which the people for whom you are designing are also members of your design and research teams

The team also incorporated several interviewing techniques including flash cards, guided tours, resource flows, etc.²³⁻²⁴

Next, for the interviews, we chose a semi-structured interview approach, developed an [interview guide](#), and then prepared and practiced interviewing other research teammates. The preparation included training for bias awareness (discussing our previous experiences and backgrounds and how they affect our views), bias journaling (journaling about all the biases we bring to this work related to our experiences and thoughts about technology, government, education, digital tools, etc.), observing versus interpreting (differentiating between objective observation [what we see] versus subjective documentation [what we infer or the effect of the lens through which we see]), and other interview techniques. These trainings were done in order to lessen the influence of our bias, biased interpretations, and preconceived notions of what we thought people needed or wanted. We wanted to let the qualitative data speak on its own.

Recruit Research Participants and Organizations

The first author served as logistician while the entire team helped recruit. The team sought to recruit several profiles in accordance with defined audiences (Table I) as well as groups or organizations who were doing similar work from which we could learn.

- Potential learners - these are potential students outside of government
- Potential mentors - these are current government technologists most probably at 18F, USDS, or the PIF program.
- Government agency executives - these are decision-makers within the government who could potential decide to pay for the program and bring it to their office, division, bureau, team, department, or agency.
- Training programs - any training or fellowship program educating students over longer-periods of time in similar methodologies
- Mentoring program - any program (regardless of topic) that pairs mentors and mentees in order to learn from their best practices
- Tech Training NGOs - NGOs with similar missions who may be able to share their lessons learned in starting a similar initiative

Table II illuminates the number and institution of the recruited participants.

Conduct Fieldwork

The research team conducted 25 interviews and 5 observations over 5 weeks throughout the Washington, DC area. This includes 12 potential learners, 5 potential mentors, 8 agencies and divisions, 5 NGOs, 2 government training programs, 1 government mentoring program (Table II).

Observations and background research was conducted for the 5 NGOs, 2 government training programs, and 1 government mentoring. All potential learners, mentors, and agency representatives participated in individual interviews. Each interview was in-person and 45-60 minutes long with no compensation given. Written and aural informed consent was given before any interview took place. The interviews were audio or video recorded and transcribed.

TABLE II
RESEARCH COMMUNITIES

Role or Organization	Description
12 potential learners	Recruited initially through General Assembly and branching out from there
USAID	Office of the Chief Innovation Officer & Executive Director of the U.S. Global Development Lab
GSA	Head of the Office of Products and Programs in the Technology Transformation Services (TTS)
	The founding member of GSA Digital Service in the Deputy CIO office
	Deputy Director of 18F
VA	Founding Member and Deputy Director of US Digital Service at the Department of Veterans Affairs
	Deputy Director of the VA Center for Innovation
EPA	CTO
Ed Dept	Chief Digital Service Officer
5 potential mentors	All technologists recruited from within 18F
US Government Open Opportunities	Director of this mentoring and upskilling program within the US Government
Code for America	We spoke with former fellows and researched this organization that enlists and trains technology professionals to work with city governments to build open source apps and improve the way cities create and use technology.

Code for Progress	We spoke with former fellows and researched this fellowship program that trains women and people of color to become junior, back-end or front-end web developers in 5 months.
5 NGOs	We observed, researched, and spoke with NGOs (including Code for America and Code for Progress) that focused on technology education.

After this step, we paused to reconsider the challenge. Often after conducting initial discovery research, we find that the the challenge is not actually a problem among those observed and interviewed. Or we may find the problem is too broad or too narrow. However, in this case, all team members agreed: our qualitative research confirmed the design challenge, so it was not changed.

In the next section, we conduct synthesis, code the stories and qualitatively analyze data to extract insights and find themes. Through further analysis we unearth frameworks as learning theories and program hypotheses emerge.

DESIGN

Synthesis

Find Themes and Extract Insights

Key insights grouped by themes are seen in Table III. First, we collaboratively coded all qualitative data through negotiation. We deconstructed all the data into single-idea, individual quotes, facts, and observations. Then we connected various quotes, facts, and observations to extract hidden insights (right column of Table III) not directly captured in a quote, fact, or observation. We then grouped all insights, facts, quotes, and observations into broad categories or themes. We regrouped and regrouped the themes until we felt the final themes were on the same high level, spoke about similar things, and captured the emerging patterns in the data. The theme of budget, hiring, and procurement did not emerge in interviews with potential mentors. However it emerged in 100% of interviews with all potential agency partners and all potential learners. All other themes emerged in 100% of all interviews and observations across all groups. The final high-level themes are in the left column of Table III. Because insights do not capture all of the data (facts, quotes, observations), it is important to highlight crucial points or patterns throughout the data. Also due to the large number of insights, we want to summarize the important points in each theme that shape the future design of Agile Corps.

- Time, Money, & Sustainability - The main difficulty in designing Agile Corps is hiring and whether or not federal government agencies that partner with 18F in this program will hire the trainees before training starts, during training, or afterwards. Also what status would the students have during the training? Would they be employed by 18F as temporary

federal employees until the program ended and they were hired by a federal agency? The insights around the theme of time, money, and sustainability point to the fact that the government process is so long and roughly as long as a 6-12 month Agile Corps program or the 12-month planning process for each year of Agile Corps (finding projects and federal agencies the corps members could help) or the application process which starts roughly a year in advance. The insights here point to an opportunity that the hiring process could be occurring in parallel either with the application process or in parallel with the program so that learners could be hired by the time the fellowship completed so as to minimize gaps in employment or income.

- Work Environment, Life, & Salary Needs - Potential fellowship students desire a livable wage due to the high cost of living in Washington, DC. Otherwise, they will not be interested.

TABLE III
INSIGHTS GROUPED BY THEMES

Themes	Insights
Time, Money, and Sustainability	<ol style="list-style-type: none"> 1. The length of the government hiring process may align with potential length of the Agile Corps program. 2. The government hiring process and future Agile Corps application process may have similar durations. 3. The government hiring process and future Agile Corps annual planning process (including the application process) may have similar durations.
Work Environment, Life, and Salary Needs	<ol style="list-style-type: none"> 1. A livable wage or stipend for DC is important to attract participants. 2. Ideal workplaces often do not align with typical government workplaces.
Roles, Motivation, Energy, and Culture	<ol style="list-style-type: none"> 1. There is a distrust of government and dislike of government jobs among those outside the government. 2. Job placement is a motivating factor for a potential participant. 3. People prefer the non-profit sector over the public sector even though both are mission-minded. 4. There is a willingness to take on side projects to help build skills and a portfolio as a developing technologist. 5. Feedback on work helps build confidence for designers. 6. Participants would value seeing how others approach and solve real world problems. 7. Any training program must find the right mix of internal government people vs external people.

Skills and Knowledge	<ol style="list-style-type: none"> 1. Data Science is an important skill set to teach for technologists. 2. HCD training is important to agencies & potential participants. 3. Communication is a key skill to grow that would benefit participants throughout their careers. 4. Being a good mentor may require training. 5. Due to the role of acquisitions in government IT, product management (PM) skills are needed in addition to software engineering and design skills in some agencies. 6. The top hard skills identified are: <ul style="list-style-type: none"> • Front-end development skills • Back end development skills • User Experience (UX) skills • Agile training (in addition to HCD, PM, & data science) 7. The top soft skills identified are: <ul style="list-style-type: none"> • communication • adaptability • empathy • research • facilitation • problem definition/solving/strategy
Instructional Design, Delivery, and Resources	<ol style="list-style-type: none"> 1. A community of practice helps build skills both during and after similar fellowship programs and jobs. 2. Training produces better results when localized, teaching skills specific to the future environment in which students will operate. 3. Training programs increase learnings when they promote opportunities for peer learning. 4. There is some unspecified amount of time needed to teach concepts and skills before working directly on projects. 5. Blended learning may be preferred by potential participants. 6. Experiential learning is preferred and appears most impacting.
Budget, Hiring, and Procuring	<ol style="list-style-type: none"> 1. Initiative is more important than skills when evaluating potential candidates. 2. Organizational leaders are looking for candidates that can make an impact on the business bottom line, looking for individuals who can generate revenue for their department or organization and sell ideas internally. 3. Agencies tend to hire software engineers with more experience, leaving a void for junior-level engineers to get real-world work experience. 4. Security clearances can be a hindrance for junior technologists.

	<ol style="list-style-type: none"> 5. Training & return on investment (ROI) deter agencies from junior or mid-level talent. 6. Hiring is a source of frustration for agencies. 7. Budget and HR processes are obstacles to bringing outside people in. 8. Agencies seem to prefer hiring and creating in-house design teams rather than relying on contractors. 9. Agencies looking to build digital teams are losing qualified candidates due to the timeframe of the hiring process. 10. It is often faster for an agency to procure talent, than to hire it. 11. Some agencies resort to contracting subpar talent. 12. There is a lot of unused training money in government.
Professional Development	<ol style="list-style-type: none"> 1. Mentees have a desire to find a mentor who understands their career path and the struggles they face as new designers. 2. Mentees benefit most from having one skills-based mentor in the same discipline as the mentee as well as exposure to multiple mentors across different disciplines. 3. Mentors seek to share their knowledge with younger designers. 4. How to be a good mentor is not obvious or intuitive for many people. 5. Interested 18F mentors may only have 1-4 hours a week for mentoring.
Organization	<ol style="list-style-type: none"> 1. In federal government digital services, there is a need for multi-skilled people who can work on many levels. 2. Hiring, budget, procurement, and professional development are barriers to creating a community of junior & mid-level technologists in the US federal government. 3. For agency senior management, quality is the prioritized characteristic of successful technology software or software acquisitions.

- Roles, Motivation, Energy, and Culture - Any training program bringing in people into government must deal with the negative views of government held by many potential participants. Potential participants want guaranteed job placement; they dislike giving up a job to go through a possible full-time training program with no promise of a job. Another important point is that if you mix internal government learners with external learners, there is an optimal mix for the maximum peer-to-peer motivation, encouragement, and learning.
- Skills and Knowledge - Agency executives want employees with data science and product management (not project management) skills in addition to software engineering and design skills. Surprisingly, there are a number of soft skills that are important for technologists to learn outside of their technical skills. All technologists also need to learn

the Agile philosophy and mindset. Additionally, mentors will require training to be good mentors (mentoring is not a natural skill that everyone has).

- Instructional Design, Delivery, and Resources - In this theme, we learned that the best training is experiential, localized, and blended. It also includes peer-learning and communities of practice.
- Budget, Hiring, and Procuring - This theme had the largest number of insights and described the biggest obstacles to designing a solution. Because it is difficult to fire people, it is also difficult to hire people since hiring then requires an increase in budget. Without an increase in budget, only very few technologists are able to be hired by federal government agencies. However, the second large hurdle is the long, convoluted hiring process that takes too long, so long that often highly qualified candidates have taken other jobs when they find out the government wants to move forward in the interview process or wants to hire them. If a federal agency is able to hire someone at this point, the process can be further slowed down by the security clearance process by which point more candidates have taken other opportunities. When federal agencies do hire someone, they tend to hire senior technologists and not junior and mid-level technologists as they are worried about ROI and having to train the junior employee. Still, due to the original barrier, many federal government agencies solve talent problems through contracting or procuring the work. Through this route of acquiring software (acquisitions) from vendors or contractors, agencies pay a premium price and often receive subpar software. These problems occur at the same time that most of the training budget of many federal government offices is unused.
- Professional Development - Within 18F, mentors have limited time to provide professional development.
- Organization - Through a card sort interview technique, we learned that the majority of executives interviewed preferred high quality more than high speed, high efficiency, or high output in software design and development as well as digital acquisitions. Quality is their number one concern. They are looking for people with multiple skills who can work at high levels (such as forming strategy) and low levels such as project implementation. They also are aware of the huge barriers there are to hiring, training, and retaining junior and mid-level technologists. One insight here is that even when hired, junior and mid-level technologists lack good professional development or a clear pathway to develop themselves and move into mid-level and senior roles.

Uncover Patterns, Learning Theories, and Frameworks

If an insight is a subtextual inference deduced from different pieces of textual evidence none of which state the insight explicitly, then a pattern, as we define it here, is a textually repeated statement found in multiple quotes. We pause to focus on five recurring patterns found across interviews that uphold our program hypothesis. None of the three, contextual learning theories were upheld. Our research supported the use of PBL, mentor coaching, and a multi-month model. However, the macro theories around program design were called into question.

First, the senior managers and executives have a demand for training in three areas we did not anticipate - product management, data science, and IT security (also called cybersecurity). Due to

this shift, we expanded the tracks of our program hypothesis from 2 (software engineering and UX design) to 4 tracks including product management and data science. Even though cybersecurity was mentioned by all senior managers and executives, we were not certain we should offer it as a separate track or integrate it into all tracks.

The second shift in our thinking due to our research was the need to shorten the length of the program. We initially hypothesized a program of 12-15 months. Eighty percent of the managers and executives interviewed said it was too long. They preferred something that allowed them to see results within the same calendar year. We adjusted our program hypothesis to be variable, between 6 to 12 months.

Third, senior managers and executives repeatedly stated they could not release workers for a full-time program, even for 1 week much less a full day. They wanted a program that people could do while still completing their work in their jobs instead of, in effect, doing a rotation away from their jobs for the length of the program.

Fourth, we heard by all managers and executives that if Agile Corps was not a PSL program that trained people outside of Washington, DC they would never be interested since most of their employees worked around the country (and some overseas). They needed a way for any PSL program to be experienced by people who were not in Washington, DC.

Finally, repeatedly, senior managers and executives in federal government agencies stated they want a program that not only brings in people from the outside but trains their current staff. Hiring is so difficult. They prefer a PSL program that finds value in their current staff and facilitates investment in them. A third of managers and executives interviewed admitted that not all current staff would be excited about new methodologies from the private sector, but there are enough who are that a mixed program was preferable. The barrier to hiring, that motivates managers to prefer a program that trains internal people, leads us to the following relational framework that arose out of our research (Figure I).

FIGURE I
THE CONNECTION BETWEEN PROBLEMS IN HIRING, FIRING, BUDGET, AND THE CONTRACTOR
SHADOW GOVERNMENT

Our research unearthed two major obstacles to hiring people. The first problem is a lack of increased budget. In order for a federal government agency to hire new people, they must have more budget than the amount granted to them for the last or current fiscal year. This rarely

happened or when it did it was allocated in ways that the increased money was not for hiring more people but for other administrative, program, or acquisition expenses. Still that would not fully stop hiring as one can replace people who leave.

The second problem, however, is an inability to fire people in the federal government. It is possible to fire someone, but the process is so detailed and laborious that no manager goes through it. A manager must keep detailed notes of all of the failures of an employee to do their job and all of the interventions tried. This must be done consistently over a period of three years in order to actually fire someone. According to managers and executives, no one has the time for that. Instead, we found that a manager will more likely “promote” the employee to another group, team, office, or division so that another group of people must deal with the employee. Or the manager would isolate the employee, minimize the work assigned, and relegate the employee to a position of little potential influence or harm. Often this is done to make the employee unhappy enough that the employee quits. Since a manager or an executive effectively cannot fire an employee, in times where there is not an increase in budget, backfilling hiring positions open up when people leave.

Even though agency and department divisions may not have hiring money they still do have money to hire contractors and vendors and to acquire new technology from those vendors and contractors through the acquisition process. This often chosen route increases the number of non-government contractors actually doing the work that a hired government employee could have done if that person were hired. In fact there are more contractors doing government work, today than direct federal government hires. This large group of contractors doing most of the federal government work is called the contractor shadow government. When departments use an acquisition process involving contractors or vendors to build software technology instead of hiring internal talent to do it, the contractor shadow government grows⁴⁸⁻⁴⁹.

Even in the case that internal positions do open up for technologists (which we now define as software engineering, design, data science, product management, or cybersecurity), as stated earlier, the hiring process takes so long that the best talent often has left the process throughout the hiring pipeline (Figure II)⁵⁰. Even if a government agency seeks to hire multiple people, there is often only one person left in the job application pipeline, to whom to extend an offer.

Regardless of the source of the problem, Figure I highlights an important truth and obstacle. Agile Corps, in its current conceptualization, cannot exist until the hiring problem is solved. In other words, the program design solution we seek must also solve the government hiring problem. That is a large in-born challenge and a crucial finding that the solution must address.

FIGURE II
THE LONG DURATION OF THE FEDERAL GOVERNMENT HIRING PROCESS

Prototyping

Find Opportunity Areas

Opportunity areas are gateways to idea generation. Because a solution to any design challenge can open up a number of opportunities, we first brainstorm and choose a small number of opportunity areas to guide our brainstorming. Then we brainstorm in the direction of the opportunity area. Opportunity areas are usually phrased as “how might we” questions and rearticulate a problem or need in a future, open-ended, generative way.

The research team first brainstormed a list of 40 [possible opportunities to pursue](#) in coming up with solutions. The team then narrowed the list down to the top 12 and then to the final, top 4 opportunities (Table IV). Opportunities 2 and 3 provide space to address the hiring challenge.

TABLE IV
OPPORTUNITY AREAS

Number	Opportunity
1	How might we design a training program that reduces hiring time?
2	How might we design a training program that does not require participants to attend in-person?
3	How might we design a training program that works WITH agency HR training program, and not against it?
4	How might we design a training program that is personalized?

Brainstorm and Build the Concept

Next, we started the brainstorming process. There are two general ways in which this usually proceeds in a human-centered design process. Some projects, due to the nature of the project, lend themselves to brainstorming entire solutions as an idea. Other projects, due to their nature, naturally lend themselves to brainstorming pieces of the solution that is needed. In the first case, a design team can actually prototype a single brainstormed suggestion and see how the community reacts to it. In the second case, the design team must combine various brainstormed ideas into an aggregate idea before prototyping because each idea is not a potential solution by itself. This project fell in the latter category in which ideas people naturally brainstormed were partial ideas and needed to be combined with others to “build a concept.”

We [brainstormed 67 different solutions](#) or partial ideas for each of the opportunity areas, including the examples below.

- A massive open online course (MOOC)
- A service-learning program that starts the hiring process while they are working and doing service-learning through 18F so that by the time they complete the service learning training, they can join their agency as an officially hired employee
- A service-learning program that puts the overhead burden (recruiting, hiring, training, etc.) on 18F leaving only the salary of the learner to be paid by the federal government agency
- A service-learning program that focuses on project-based learning using open-ended, large projects (participants can work on things most relevant to them and to the skills they most want to learn)

We then combined our top choices of ideas from each opportunity area in order to build a robust concept that addresses all 4 top opportunity areas, [creating a concept](#) that we could prototype and test. The concept is presented below through lenses of funding, recruitment and hiring, projects, and curriculum.

- Funding
 - Agency partners earmark training dollars specifically for the Agile Corps program.
 - 18F advises agency HR programs helping them design budget requests for succeeding years to incorporate more junior and mid-level technologists.
 - 18F is compensated for advisory services.
- Recruitment, Training, and Hiring
 - 18F Talent team adds training to their Recruitment-as-a-Service offering (RaaS) in which they recruit for federal government agencies for a fee.
 - 18F builds partnerships with outside organizations for recruitment.
 - Agile Corps PSL is the new onboarding process at agencies for their tech hires.
 - They join Agile Corps in order to upskill and prepare for their work in the agency.
 - 2 paths
 - If already an employee of the agency, the agency gives 18F their salary money allowing the employee to enter into Agile Corps through a reimbursable detail. Once the program is done, they re-enter their agency.
 - If the employee is recruited from outside the government, 18F hires them as a term-limited (temporary) employee for the duration of the Agile-Corps program, during which they are going through the hiring process at their agency. By the end of program, hopefully they will be hired by the agency.
- Projects
 - Projects focus on citizen engagement and citizen-facing products and services. The agencies run the program (sourcing and vetting the projects), and they manage citizen participants.
 - Employees assemble project teams in their physical area.
- Curriculum
 - Online learning

- Virtual critiques of the work products (online peer assessments)
- Online self-assessment portal
- External curated content in addition to
- Core courses on hard tech skills with electives on the soft skills that each student chooses to develop
- Elective courses are open to other agencies outside of core program
- Series of workshops and lectures that occur on a rolling basis throughout the year. Any government worker can attend.
- Pre-diagnostic skill assessment that affects learning design
- Students choose courses they need to create specialization they want from a set of 18F University courses. They can jump into course, and then jump into another to build their path.

Prototype, Test, and Collect Feedback

In HCD, our prototyping and testing is completely guided by unanswered questions. The design team listed a [set of unanswered questions](#) after creating the concept to test (Table V). We needed a prototype that could elicit answers to these questions before we invested money in a potentially big pilot during the delivery phase.

So, we created a [program description](#) and a [syllabus](#) to circulate for feedback, especially with some of the same groups who helped during the research phase.

TABLE V
LINGERING QUESTIONS AND FEEDBACK RESPONSE

Question	Response
18F Talent	
Can we post on 18F Join us page?	We will only consider doing so if the program finds funding and we decide to bring in students through an 18F hiring mechanism as opposed to the agency hiring them directly.
Will you add training to RaaS (Recruitment-as-a-Service)?	We are still working on the RaaS model and have only one potential client. We are not sure of the future of this offering. It is possible we may offer training as well which would coordinate well with Agile Corps where the training is a service we offer, but the agency pays for it.
General	
What are the pros/cons to using USAjobs.gov?	You likely will not have a choice if the hiring is done through an agency. It will be required for many agencies for most jobs. If the hiring is done through 18F, then it does not have to be on

	USAjobs.gov. One benefit of using the page is wider viewing of the job posting.
Can we promote on USAjobs.gov but link to 18F join us page?	No answer found.
What is the specific selection criteria (weighting for different criteria)?	This depends on the job ladder or job series chosen for the job and the agency doing the hiring.
Agencies	
How much time will you allow your worker to participate in the program?	The 15 months in the syllabus is too long. Even 12 months is too long.
What percentage of government and non-government PSL students would you support?	No agencies said they would support any non-government PSL students.
Would this save you taxpayer money?	It is possible but is hard to calculate or determine. It would definitely help us use training money that is wasted. And that training money will help us be better at our jobs, increasing our efficiency. So we believe so. We do not know how to quantify the amount, though.
Mentees	
Is there compensation for their time?	Yes, because of increasing pressure on 18F to be cost-recoverable, no 18F employees can participate as mentees without having a client project towards which to bill their hours.
At what GS-level can a potential mentor participate?	There was no concern over this question. As long as the mentor knew the area of expertise that was requested, this did not matter.

As noted above (Table V), questions of talent (HR) and job posting were all dependent on having more information of which agencies would become an Agile Corps client and create a PSL program. So the major learning during our prototype phase was feedback from the agencies, though there were a few learnings related to provision of 18F mentors, as well.

First, Agencies asked us to add a track for cybersecurity. We had heard it mentioned by agencies during the research phase, but we were not yet sure Agile Corps should offer a track in it, due to its highly specialized nature and whether we had a philosophy of security being a specific discipline or security being something all disciplines should learn.

Second, Agencies, again, said a 12-15 month program is too long. We knew this already from the research but wanted to test it experimentally with agency executives and see if they would be

willing to pay for a program at that length. None were. In fact, even 12 months was too much. They asked us to drop the length again to at most 6 months.

Third, the major setback to the original concept of the PSL program, Agile Corps, is that no government agencies were willing to invest money and pilot the program with students outside of government. In order to run a program with participants entering from outside the government, the hiring problem must be solved. Our prototype solved the hiring problem by having 18F (with a fast hiring process) perform an initial temporary hiring and then train participants while the agency continues its hiring process in the background. This would give the agencies more time to complete their hiring process while service-learning and training could still begin. The hope is that the agency hiring process would be complete by the time the training program was over. Our prototype requires 18F to offer this training and recruitment service for agencies; however, the 18F Talent team, though willing, was not yet ready to say yes to adding a training component to their new RaaS offering because they were still testing the model. Therefore, in order to prototype quickly, we realized we must offer a 100% internal, government program, at least for initial piloting in order to find a client. Later, when the 18F Talent team is ready to add training to the RaaS offering, the more robust version of the prototype that solves the hiring problem can be tested. Without that solution to the hiring process, no agency was willing to do a program even with 50% of participants entering from outside the government.

Lastly, the Agile Corps program needed a paying federal government agency who would also pay for the time of the 18F mentors mentoring the program participants of the agency. This is due to the fact that 18F required that mentors be able to bill their time. Otherwise, 18F mentors had to limit their mentoring within the non-billable 8 hours per week. However, given that many 18F employees already had that time filled with meetings for all of 18F, their chapter, their guild, their working groups, their lead, their supervisor, their director, volunteer projects, interviewing, and more, it was hard to see how this would work. Moreover, the demand for mentor time was expected to be much beyond 8 hours over the course of 6 or 12 months.

This led to iterating our prototype, meaning creating new versions of our prototype based on feedback and revisiting groups again for more feedback. We developed a [2nd version of the program description](#), a [2nd 12-month version of the syllabus](#) with a security track, and then a [3rd 6-month version of the syllabus](#).

Finally, because it was difficult for agencies to tell us how much they would be willing to pay for this program, and because we wanted to run an actual experiment and make them decide to purchase it or not, we created a [cost model](#) for a 3-month and 6-month PSL program as well as a [pitch deck](#) as part of the prototype. Then we tried our best to sell a 3-month or 6-month, internal-only program.

RESULTS

The [Department of Labor](#) (DOL) [Wage and Hour Division](#) (WHD) was interested in our program, and we were invited to pitch the idea to them. They preferred a 3-month program to start, but requested a different track than any offered. The Wage and Hour Division asked if we could teach the general design, launch, and build methodologies of HCD, Lean Startup, and Agile across all disciplines including software engineering and IT staff but also communications, finance, HR, project management, and other job ladders. Being in line with the mission of the educational arm

of 18F (18F Learn), to spread these methodologies across the federal government, the design team said yes and agreed to pivot (alter) the program offering a mixed track to engineers and non-engineers in order to pilot the program.

Additionally, it provided a great PSL opportunity, as the employees work on a range of public service work that needed help in improving efficiency and effectiveness through design. These WHD public service work opportunities included better tracking down and finding large employers who do not pay their (usually) low-wage workers the wages they are due, better collecting those back wages, and better delivering those back wages to those workers.

Before agreeing they wanted to see a quick prototype of the topics their employees would learn in HCD, Lean Startup, Agile, and general design, applied to their job. We prototyped a sample mixed-track design syllabus, and DOL-WHD was happy to sign an inter-agency agreement to bring the Agile Corps to their agency for a \$256,000 pilot. Part II of this paper will explore the impact and effectiveness of the first pilot with the DOL Wage and Hour Division.

Additionally, the EPA began talks with us for a software engineering and developer track, and the [Department of Treasury Office of Financial Research](#) (OFR) went even further and began contract negotiations with us for a software design track.

LIMITATIONS

The main limitation of the work is the sampling of the federal agency partners. It would be improved by interviewing managers in agencies that represent the extreme and the mainstream of certain statistics. For instance, for the characteristic of size or number of employees, the Department of Defense (DOD) is the largest and the Federal Election Commission (FEC) is one of the smallest. It would be good to include them or agencies near their size along with agencies of average size (which we have in the current sample). The sample would be improved if we included agencies on the extreme ends of the spectrum and in the mainstream for a few other characteristics like hiring budget and digital modernization. However, even if the sample is improved, it is the opinion of the research team that the results would be the same in terms of the themes and insights, due to the team's experience with most other agencies on other projects outside of the Agile Corps design project.

The second limitation of the work is a usual one when applying DBIR and HCD to complex social problems. Unlike the private sector application of DBIR and HCD to a single problem to create a product for financial gain, this work applies DBIR and HCD to a social problem and therefore must deal with an entire complex, adaptive system of interrelated actors, dynamics, and interactions. Human-centered design, when practiced well, includes systems thinking. This work has uncovered the foundational importance of hiring as a key or barrier to designing a program that addresses the shortage of junior and mid-level technologists in government. As a result the developed prototype utilizes an already micrcosmal solution to the problem of government hiring at 18F. 18F has been able to hire people much more quickly than the average agency hiring time. However, for the actual prototype to be tested, 18F must be willing to add training to an experimental new recruitment service (RaaS) offered to agencies, which introduces another stakeholder for whom to design. The nature of applying design to such social problems means that one must design not just for the end user or learner, in this case the Agile Corps learner and government worker. Additionally, one must design for a whole host of secondary users without

which the program will not work or from whom, it will receive resistance; in this case, that is agency managers, Congress, 18F government mentors, and the 18F Talent team. As a result of the 18F Talent team not yet being ready, the revised prototype avoids the hiring problem by using 100% internal government workers.

FUTURE WORK

As stated before, the next steps are to run a \$256,000 pilot with the DOL and use any generalizable learnings to run improved pilots for the EPA and at the OFR at Treasury. Beyond these pilots, the largest piece of future work bifurcates down two paths. One path is to run a pilot of the original prototype in which 18F uses its faster hiring mechanism to bring people into the government and run Agile Corps while the longer agency hiring process continues in the background. This requires the 18F Talent team adding training to its RaaS offering. The second path to pursue is to determine if the goal, of increased junior and mid-level technologists, can be achieved with a 100% internal government Agile Corps along with normal hiring rates (hiring still occurs but only as budgets allow and with the current slow mechanism; and whoever is hired through the normal hiring process is trained through Agile Corps). In other words, does the new 100% internal prototype model, that will be piloted at DOL, work to solve the problem?

CONCLUSION

Public service-learning (PSL) is a learning approach and strategy that combines learning objectives, instruction, and reflection with, specifically, public or government service on behalf of the public. In exploring the design of such a program, this work demonstrates a few advantages and disadvantages PSL programs have over traditional service-learning programs.

First, in the Agile Corps model, because PSL participants are adult, government workers, service projects do not need to be found; they are already inherently part of their work. Government workers are already engaged in public service every day of the workweek. In contrast, non-public service-learning, whether as a pedagogical approach or a program, often requires finding service projects for the usually non-working students to participate. Service is not a part of their job as students. On the other hand, a disadvantage is the scheduling of learning time for PSL for government workers. Public service is built into their work day but explicitly designed educational experiences are not. With many trainings budgets for individuals across the federal government go unused by the end of each fiscal year.

Second, PSL naturally create a balance between benefits to the learner and benefits to the public community when a PSL program is designed to focus on educational benefits of the learner. Because the learner is a government worker, any education that improves that worker's quality or quantity of work directly affects the public service to which that worker contributes. All government worker education affects the public by improving the workers skills and ability to do public service. Though, it is also possible to create PSL experience that focus on the public alone, this automatic and inherent link between benefit to the learner intricately tied to benefit to the public community is unique to PSL. Traditional, non-public service learner can be focused on benefit to the learner, benefit to the community, or equal benefit to both.

In this work, we presented the use of a human-centered design (HCD) methodology to guide the design-based implementation research process, creating a public-service learning (PSL) program in the federal government that better finds, recruits, trains, retains, and grows junior and mid-level engineers and technologists in the federal government. Our aim is not just to design such a program but to eventually prototype and implement a program by finding an agency partner.

The importance of the program relates to the status quo of IT projects in the government. Most projects fail either due to being over-budget, delayed, canceled, or, if delivered, not user-friendly or outdated. Federal agencies usually contract out IT talent at a premium price and still receive similar results. The impetus to design this program is to see if we can find, train, and create career pathways for good, yet lower-priced, talent at the junior and mid-level career range.

The most important high-level themes that emerge from our work are time, money, and sustainability; work environment, life, and salary needs; roles, motivation, energy, and culture; skills and knowledge; instructional design, delivery, and resources; budget, hiring, and procuring; professional development, and organization. The most important are those that act as a barrier to bringing people into government (a pillar of the original design), specifically budget, hiring, and procuring.

The most important framework we find highlights that, due to an inability to fire or increase department budgets much, most agencies have an inability to hire the talent needed. This leads to the use of vendors and contractors. If we cannot solve this hiring problem, we cannot implement Agile Corps as originally prototyped to include a mix of government employees and non-government employees hired into government. It will simply solve the hiring problem by avoiding it and becoming an internal government training program. An interesting question remains of whether the number of high-level junior and mid-level technologists in government can be increased solely through an internal program and normal hiring rates instead of creating a 50-50 internal-external program through increased hiring rates. We do not know the answer to that but it is a possible direction to pursue in future work. This work has definitely shown the importance of having innovation labs and groups inside an agency empowered to run new experiments to improve government processes. For instance, without the example of 18F at GSA, GSA would have never had a faster mechanism to hire people into its innovation unit at 18F. It seems that other agencies could also benefit from solving government-wide issues at the agency level through internal, design and innovation labs and units.

In this work, the design shifted in 5 ways to follow user (learner, mentor, agency executive) needs. First, we shifted from 2 tracks (design, and software engineering) to 6 tracks (design, software engineering, security, product management, data science, mixed). Second, the program duration shifted from 15 months to 3 months or 6 months. Third, the program shifted from a full-time, multi-month program to a program that required only a few hours a day, a few days a week allowing workers to still work most of the time. Fourth, it shifted from a DC program to a program all over the States involving online synchronous and asynchronous education. Fifth, it shifted from a 100% non-government participant program to a 50-50 program mixing internal government participants with external participants hired into government.

By avoiding the hiring program, the only possible pilot of the program can be a 100% internal program which leaves the question of whether a 100% internal program is a possible solution. We do not know, but this is exactly the type of 3-month, mixed program purchased by the Department of Labor (DOL) Wage and Hour Division for \$256,000. They were the first and only agency to

request a mixed track where participant learn to apply HCD, Lean Startup, and Agile to their job regardless of the function, engineering or non-engineering (i.e. finance, HR, legal, communications, etc.).

The EPA is in talks with the design team for the software engineering track. The Department of Treasury Office of Financial Research is in contract negotiations for the design track for a cohort of their employees. Part II of this paper will explore the impact of the first DOL pilot.

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