Learnteer: Guided Volunteering for Quality Work and Professional Development

ABSTRACT

The success of a nonprofit depends on having a strong volunteer workforce that can produce quality work. However, most nonprofits lack time to create training material for their volunteers to ensure quality work. This leads to poor work that neither serves the nonprofit nor volunteers (i.e., in terms of professional growth). To provide better quality work to nonprofits and start to generate better learning opportunities for volunteers, we introduce Learnteer, a system that builds pipelines to more systematically produce quality volunteer work that is more helpful for nonprofits. Learnteer can also help volunteers obtain better job opportunities by generating tutorials that guide people through the volunteer task instance, as well as through higher-level concepts related to the underlying skill set required. Learnteer thus frees nonprofits from investing time in training. Learnteer also incorporates tips from experienced nonprofit leaders and professionals with the purpose of creating tutorials updated with the needs of both industry and nonprofits. Using machine learning on crowdsourced tips, Learnteer dynamically determines what tips to present to an incoming volunteer to maximize the quality of the volunteer work she produces to cover the needs of both the nonprofits and the industry. Field experiments demonstrate that nonprofit leaders and professionals find Learnteer helps volunteers produce higher quality work that is helpful for nonprofits and for obtaining a desired professional job. Our results point to a future where volunteering can be turned into a skill-building process that benefits both the collective and the individuals.

INTRODUCTION

Volunteering helps deliver critical services and expertise to communities through nonprofit organizations [10]. Example volunteer tasks include firefighting, cooking meals for homebound seniors, designing flyers for fundraiser events, or programming mobile apps that help nonprofits organize their information on-the-go. However, for every successful service that volunteering offers, there are many that never managed to be delivered. For example, Wikipedia was the only large-scale volunteer-run encyclopedia that succeeded out of eight independent parallel attempts at providing the same service [9].

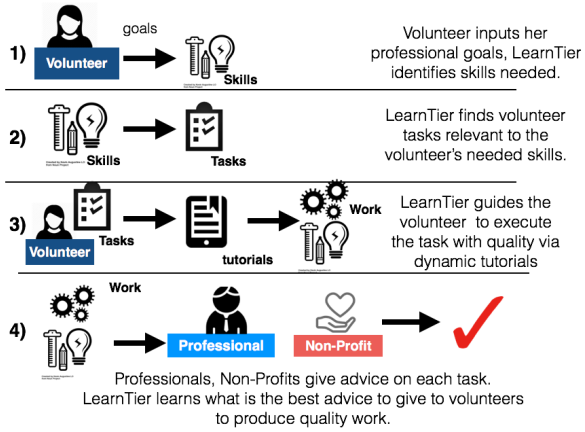

Figure 1. Learnteer's steps for guiding volunteers to execute quality work that serves both the nonprofit and volunteers' professional goals.

Many volunteer efforts fail because volunteers lack the adequate training to coordinate and execute the work [10, 15, 18]. However, most non-profits do not provide training altogether to volunteers [4, 14], as they consider time spent on creating training materials and offering training courses is time not spent helping the community. For organizations focusing on crisis management, this lost time is critical as it can be the difference between life and death. Consequently, most nonprofits work with volunteers that are not trained in the tasks they conduct; thus resulting in low quality work.

When thinking about obtaining quality work from volunteers, we also have to consider that although volunteering is typically altruistic in its nature, volunteers are more likely to provide higher-quality work and stay engaged longer if the experience helps them towards their personal or professional goals, e.g., getting a better job [21]. Furthermore, it is not rare for people to choose to volunteer as way of getting familiar with a new field or area of work [3], in which case the professional motivations are even more important.

While a few nonprofits do offer training to help volunteers grow, this training is not always aligned with the volunteers' personal goals. Volunteering can be integrated in people's everyday activities [17], so it is critical that we articulate how volunteering and personal development will mesh with one another; and also how we can focus on ensuring quality volunteer work. Addressing these problems facilitates the creation of large on-demand volunteer workforces that can tackle societal problems at large.

To help nonprofits produce higher quality work, we introduce *Learnteer*. Learnteer is an end-to-end system that guides people to execute volunteer quality tasks to positively impact

nonprofits and help volunteers get better future jobs by improving their portfolios. Learnteer generates dynamic tutorials that guide people through each volunteer task instance, and also provides information on higher-level required concepts to help volunteers produce quality work regardless of their experience. The system focuses on guiding people to execute tasks that will likely serve the person to improve their resume and obtain their desired job. For instance, given a person's goal of *"becoming a designer,"* Learnteer first identifies the most relevant skills to reach the goal, e.g., *"webpage design skills,"* or *"print design skills."* These skills are mined from social media data (especially LinkedIn) of people with the job that the volunteer aspires.Via simple keyword matching, Learnteer then identifies volunteer tasks that require such skills, *e.g. "design the landing webpage of the nonprofit," or "design printed flyers for the nonprofit's fundraiser."* Next, Learnteer dynamically creates tutorials that guide volunteers to execute the tasks with quality. Learnteer considers that the deliverables achieved through volunteering are products that will be useful for the volunteer to add to her CV; while also being useful for the community.

While designing Learnteer we considered it was important to provide volunteers with the latest tips from professionals (i.e., the latest tips from the industry); as well as with the latest tips from nonprofits. For this purpose, Learnteer has two main components: (1) an "eliciting tips" module that iteratively requests tips from experienced nonprofit leaders and professionals; and (2) a machine learning component that chooses the most effective tips to integrate into Learnteer's tutorials to help volunteers produce quality work from the standards of both nonprofits and industry.

In a field experiment comparing Learnteer to traditional online volunteering interfaces (e.g., volunteermatch.org), Learnteer successfully helped people to produce higher quality volunteer work according to both nonprofit leaders and professionals. Our results point to a future where nonprofits are freed from spending time training volunteers; but volunteers still receive the attention they need for producing quality work that benefits both the collective and themselves.

RELATED WORK

Learnteer's design is based on different areas: (1) Producing Quality in Crowd Work; (2) Skill Development for Crowd Work; (3) Interfaces for Coordinating Volunteers.

Producing Quality in Crowd Work

Researchers have recently tackled the problem of designing work flows to ensure quality, with scalable processes. Dow et al. [7] showed how timely task-specific guidance helped workers to produce better results. Oleson et al. [12], proposed the use of "gold standards" to detect low quality work and provide targeted training feedback to crowd workers. Morris et al.[11], showed how workers produced higher quality via timely tips.

Learnteer builds on these ideas to help coordinate volunteers and produce quality work. These designs are especially adopted by Learnteer's tutorials, which promote guidance and tips to foster quality work.

Skill Development for Crowd Workers

Another important problem that researchers have been tackling is the design of mechanisms through which crowd workers can learn new skills while they work. Crowdsourcing tools like Atelier for Upwork [16] or LevelUp for Photoshop [6] designed different work flows to teach crowd workers programming skills and photo editing skills, respectively. Learnteer builds off both of these systems: from LevelUp we use their concepts of tutorials to guide volunteers to execute work that requires skills they might not have. From Atelier we incorporate the idea of obtaining feedback from experts to guide and improve the work produced by novices. Note, however, that in difference to both systems we also incorporate machine learning algorithms to more effectively advise and guide workers. Additionally, our system is deployed in the context of nonprofits which might have different dynamics than crowd marketplaces.

Interfaces for Coordinating Volunteers

Several researchers have focused on building interfaces that can coordinate volunteers to produce higher quality work by engaging them, e.g., via a game that motivates one to make quality contirbutions to win. The area of "games with a purpose" has focused on designing game mechanisms that engage crowds to volunteer [19]. For instance, FoldIT [5], with its engaging game design, motivated crowds to freely submit new protein structures. Note that most games with a purpose focused on sourcing to volunteers tasks that were difficult for computers to do, but were easy for humans. As a result, most volunteers executed work that does not help their resume. For instance, FoldIT does not help people to do tasks they might need in biochemistry professions.

We have also seen extensive investigations focused on engaging volunteers to recruit them for a cause [1, 2, 13]. However, such research has yet to tackle the problem of producing quality work with volunteers, or providing mechanisms through which volunteers can also advance their own objectives.

Recently, business-oriented social networking services, like LinkedIn[1], have also started to incorporate volunteering opportunities along the job listings they offer. Such platforms follow interfaces similar to traditional online volunteering platforms. As a result, they offer volunteers no guidance as to what tasks are best for them to execute given their career goals, or even how the tasks should be executed to ensure quality.

LEARNTEER

Learnteer is an online platform that complements popular volunteering sites, such as `volunteermatch.org`. Learnteer's sources to volunteers tasks that they could add to their professional portfolio for better job opportunities. Leanrteer then guides volunteers to execute the work to help volunteers produce quality work for a nonprofit and to obtain their desired jobs. We designed Learnteer's guidance system in a highly iterative manner, controlling and testing dimensions with different prototypes. Figure XX summarizes the guidance space we considered. In the following, we discuss the design space

[1] `https://volunteer.linkedin.com/`

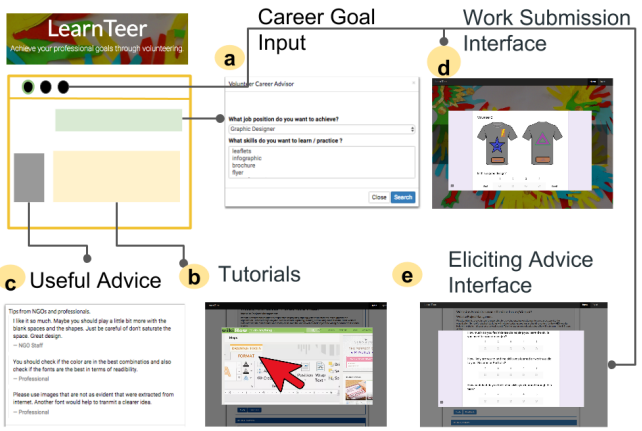

Figure 2. Learnteer enables volunteers to advance their professional goals while volunteering through an interface that: (a) identifies the skills needed for their desired job; (b) crafts tutorials that guide volunteers to do work that helps showcase their experience with the skills they need to obtain their desired job, while also producing quality volunteer work; (c) dynamically provides the most effective tips from nonprofits and professionals for producing quality work that serves nonprofits and is adequate for industry.

and eventual decisions. Our hope is that these design We designed Collabios incentive system in a highly iterative manner, controlling and testing dimensions with Wizard of Oz prototypes played as a text-based game over Google Chat. Figure 5 summarizes the space of incentive and game options we considered. Here we discuss the design space and our eventual choices. We expect that many of these decisions will be relevant to other friendsourced systems as well.

After volunteers execute the tasks, Learnteer also integrates tips from experienced nonprofit leaders, and professionals. The system learns over time what are the best tips to show to volunteers so that they will produce quality work for a nonprofit and that can also serve volunteers' portfolio to obtain their desired job.

Guided Work to Produce Quality Work

We design Learnteer based on ideas of how quality can be assured in crowd work via shepherding [7]. Learnteer thus shepherds volunteers to execute relevant tasks with quality. We consider that by having people produce quality work that uses the skills they need for their desired job, the work can serve the person's portfolio and better position the person to reach their professional goals. Having volunteers produce quality work also serves nonprofits and their own objectives. For this purpose, Learnteer: (1) identifies the skills needed for people's desired jobs; (2) finds volunteer tasks that require such skills; (3) converts the tasks into tutorials that guide volunteers to execute the work with quality to help both the objectives of nonprofits and the individual goals of volunteers. Figure 2 presents a screen shot of the Learnteer interface and how it guides volunteers to produce work relevant to the skills their desired job needs.

1. Discovering Skills Needed For Volunteers' Desired Jobs
Given a volunteer's desired job, Learnteer identifies the skills that such job requires. To accomplish this, we use LinkedIn's API to first find the skills that people, who already have the job, state to have on their Linkedin profile. We use an approach similar to tf-idf (a numerical statistic that measures how important a word is to a document in a collection or corpus) to favor skills that most people with the job mentioned; but that are not too general to be present in all LinkedIn profiles (i.e., skills that are "important" for the job). Learnteer ranks skills based on their TF-IDF score, and then takes the top 5 skills and finds tasks that require those skills. Our vision is that by helping volunteers build their portfolio with relevant work they are more likely to get their desired job. Note that in our initial approach we are using Linkedin data to identify what skills are needed for a job. However, Learnteer can expand to incorporate other sources to obtain such information.

2. Transforming Volunteer Tasks into Guided Work (Tutorials)
People generally work better with guidance and tips. For instance, systems that shepherd crowd workers as they execute their tasks generally obtain higher quality work from them [16, 7]. However, most nonprofits only provide long descriptions of the tasks without any tips or guidance. Nonprofits often lack experience on the best practices for guiding volunteers to execute the work they need [4, 14]. Worse, the lack of guidance can lead volunteers to perform only repetitive tasks they feel comfortable doing [10, 15]. This can limit the personal advancement of volunteers in their careers, as they are not doing anything new to their portfolio. Learnteer dynamically creates tutorials that guide volunteers to do new tasks. The tutorials allow volunteers to have guided instructions on how to execute the work. This enables volunteers to explore doing tasks outside their comfort zone and facilitates adding new products to their portfolio showcasing certain skills. This approach also helps nonprofits to not have to invest time and effort in learning best practices to guide volunteers.

Note that Learnteer allows nonprofits to cross-post their tasks from different volunteering sites onto the platform (e.g., to re-post tasks from `volunteermatch.org`, or `volunteerfromhome.org`, among other sites). Learnteer thus allows nonprofits to offer volunteers the opportunity to advance their professional goals while also helping their organization. Nonprofits can choose to either state the types of skills that the task might help showcase (e.g., designer skills); or simply describe the tasks as they normally do. Learnteer then uses simple keyword matching to identify the volunteering tasks that can help people showcase work related to the skills they need for their desired job. Next, Learnteer finds relevant online tutorials to help people execute work (Learnteer searches primarily for tutorials from WikiHow[2] that step-by-step show people how to do any type of task effectively). Learnteer then interweaves these online tutorials with the volunteering tasks blended as practical, real-world exercises.

As an example of how Learnteer functions, imagine a volunteer with the goal of becoming a *graphic designer*. The

[2] `http://www.wikihow.com`

system might first determine that to have such job the person needs to have *poster-making* skills. Learnteer will then provide tutorials on *how to make posters* intermixed with exercises on creating posters for nonprofits. Note, however, that the tutorials that Learnteer initially crafts might not be the most optimal to help the volunteer produce quality work. However, Learnteer integrates tips from professionals and nonprofits to evolve and craft effective tutorials over time to produce quality work.

Evolving Tutorials with Tiered Tips

Learnteer can evolve and improve its tutorials by sourcing tips from nonprofits and professionals. Each group provides unique, specialized tips: responses from experienced industry people might help volunteers to execute work in a form that better helps them to advance their professional goals; feedback from nonprofits can help volunteers produce more useful work for the community and learn how to use customer feedback, something that is helpful for almost all professional careers.

After nonprofits and professionals provide their collective input, Learnteer then uses machine learning to dynamically determine what tips it will incorporate into the tutorials given to future volunteers. Learnteer has two key parts here: (1) an *eliciting advice interface*; and (2) *policies* that select the best tips to incorporate into the tutorials. The policies are continuously updated based on how much certain tips improve the work of volunteers based on the standards from the industry and from nonprofits.

Eliciting Advice Interface

While designing the eliciting advice interface we considered two main goals: (1) supporting volunteers to execute the tasks with higher quality to help them build better portfolios for their desired job; (2) supporting volunteers to execute the tasks with the quality that nonprofits need.

Learnteer's Eliciting Advice interface thus makes requests to nonprofits and professionals per task to provide tips that will help volunteers to produce: (1) higher quality work according to industry standards; (2) higher quality work for the nonprofit. To each nonprofit leader and professional Learnteer gives a summary of the task and examples of what others volunteers have produced. This helps them to craft tips that might cover some of the most common deficiencies in volunteer's work.The tips that people have to provide are short considering that these individuals likely lack time. Learnteer is currently designed to request tips by using chat bots on social media that find and query relevant professionals and nonprofit leaders. Professionals are matched based on the skills they state on their profile. Learnteer preferences nonprofit leaders from the nonprofits it has tasks from. People can also sign up and volunteer to provide expert tips for Learnteer. Learnteer's chat bot's currently function on Linkedin. We use chat bots to ease the participation of these experts. Professionals and non profit leaders do not have to learn any new tool, or go to any new site. They can continue using their normal social media tools while providing micro advice to others.

All the tips are briefly added to the tutorials and tested on a random set of volunteers. Volunteers do their work while being exposed to certain tips. Nonprofits and professionals rate the quality of the work produced by each volunteer exposed to a certain tip. The system then gives all the ratings to Learnteer's evolving tutorials that use the data and machine learning algorithms to learn what type of tips are best to present to volunteers to produce quality work.

Generating Policies For Tutorials with Evolving Tips

The goal of this module is to generate a policy that maximizes the usefulness of the tip that is presented to volunteers given a certain objective (e.g., improving the quality of work according to nonprofit standards, or improving the quality of work according to industry standards). To this end, we formulate the following problem: we want to maximize the overall expected usefulness u by using an optimal recommendation policy $p^\star$. Mathematically, this problem can be written as:

$$\mathbf{p}^\star = \arg\max_{\mathbf{p}} \mathbb{E}_{\mathbf{p}}\left(u\right), \tag{1}$$

where $\mathbf{p}$ is a family of policies described by discrete probability mass functions (pmf) over the set of tips $\{t_i\}_{i=0}^{n}$. The expected usefulness value can be computed as

$$\begin{aligned}\mathbb{E}_{\mathbf{p}} &= \sum_{j,i} u_{j,i} \Pr\left(t_i, q_j\right) \\ &= \sum_{i,j} u_{i,j} \Pr\left(t_i\right) \Pr\left(q_j\right) \\ &= \mathbf{q}^T U \mathbf{p} \qquad (2) \\ & \qquad (3)\end{aligned}$$

where $\mathbf{q}$ is a pmf over the users (either nonprofit leaders or professionals), U is a $m \times n$ matrix holding the training usefulness scores provided by the users, and $\mathbf{p}$ is the policy over the tips. The super index T indicates transposition.

The matrix U thus registers the feedback of the j-th user in the j-th row, and the tips are organized over the columns using an index i. This means that $u_{j,i}$ is the usefulness score given by the j-th user on tip i.

The policies $\mathbf{p}$ are conditioned pmfs given a goal. This means that for each goal the system will learn a different policy.

In order to find the optimal policy we need to maximize Eq. (2). The system does not favor the feedback of any user, all of them contribute in an equal manner. This implies that the pmf $\mathbf{q}$ is a uniform distribution, i.e., $q_j = \frac{1}{m}$. The matrix U is constructed given the data. Thus, the only unknown in this problem is the policy $\mathbf{p}$.

Given that the expected usefulness depends only on $\mathbf{p}$, we can rewrite Eq.2 as follows:

$$\mathbb{E}_{\mathbf{p}}\left(u\right) = \mathbf{q}^T U \mathbf{p} = \mathbf{v}^T \mathbf{p}. \tag{4}$$

Eq.(4) is a simple dot product between $\mathbf{v} = U^T \mathbf{q}$ and $\mathbf{p}$. The maximal value of a dot product occurs when the two vectors

are aligned. This means that the optimal policy can be found in close form as follows:

$$\mathbf{p}^{\star} = \frac{1}{\sum_i v_i}\mathbf{v}, \tag{5}$$

where v_i is the i-th entry of vector $\mathbf{v}$. Intuitively, the optimal policy is the vector $\mathbf{v}$ which is normalized so that we get a valid probability mass function, i.e., $\sum_i p_i = 1$.

The optimal policy suggests that the system recommends a tip by selecting one at random following distribution $\mathbf{p}$. According to the previous formulation, this will maximize the expected usefulness over time.

EVALUATION

Learnteer consists of two core components: (1) tutorials that guide volunteers to produce quality work and an (2) evolving interface that learns what are the most useful tips to present to volunteers. We conducted two studies to examine the effectiveness of these components.

Study 1: Learnteer's Tutorials

We analyze how effective Learnteer's tutorials are for helping volunteers to (1) produce quality work in terms of the needs of nonprofits, and (2) produce quality work in terms of the needs of industry. All of this from the perspective of volunteers, nonprofits, and professionals.

Method

To study the effectiveness of Learnteer's tutorials, we conducted a between-subjects study exposing one group of volunteers to Learnteer's tutorials, while the other group was exposed to a control interface. The control interface was similar to traditional volunteering interfaces, such as **`www.volunteermatch.org`**.

Participants

We recruited volunteers using university mailing lists, social media, and word of mouth. We randomized participants into either the Learnteer tutorial condition or the control condition. We did not constrain the type of volunteering experiences to which participants had been exposed. We considered that most nonprofits typically have to work in scenarios where their volunteers have varying experiences. In our study, some volunteer participants ranged from no experience in volunteering to years working for nonprofits. To better control for volunteers' work quality and avoid introducing bias from the volunteering skills that participants might have acquired previously, all volunteer participants completed a survey previous to the study. We balanced the control condition and the Learnteer condition with the same number of experienced volunteers and the same number of novices. Each condition also had the same number of volunteers with the same career goals and skill sets. All participants wrote down career jobs with skills that matched tasks available on the volunteering site.

After recruiting the volunteer participants, we asked them to write down their desired jobs. Next, we used Learnteer's chat bots to find and recruit experienced professionals who worked in areas related to these jobs. We personally contacted these professionals over social media to invite them to the study.

In parallel, we recruited individuals with leadership roles in nonprofits. We used Learnteer's chat bots to find relevant nonprofit leaders and personally contacted them to participate in our study. We randomly assigned professionals and nonprofit leaders into either control or Learnteer. All recruited professionals and nonprofit participants self-identified as experienced and had over 3 years of experience in their field. We recruited 54 volunteer participants, 30 nonprofit leaders, and 30 professionals.

Procedure

All volunteers were instructed to perform 3 tasks, and were advised to use volunteering as an opportunity to produce work that could serve their portfolio to obtain their desired job. We did this so all participants entered volunteering with a similar goal in mind. Volunteers selected the 3 tasks they wanted to execute, and submitted their work on the platform. All volunteer tasks were drawn from real tasks on volunteering platforms. We disabled Learnteer's evolution component to study Learnteer's tutorials in isolation. Following the final task, volunteers responded a questionnaire about the quality of work they felt they produced on the platform, how much they felt the work helped nonprofits, and how much they felt it helped their portfolio to get their desired job. Volunteers in general completed questions on a 4 point Likert scale. We had then the nonprofit leaders and professionals evaluate the work of each volunteer for their 3 tasks. Nonprofit leaders and professionals were unaware of the interface that volunteers had used, and were only exposed to the work produced under one condition. Note that the tasks we used in our study came from **`volunteermatch.org`** which leverages different nonprofits and tasks. Each volunteer task took approximately 30 minutes to complete. But participants could take a total of 3 hours to finish their 3 tasks if needed.

Results

All of the 54 volunteers were able to finish and submit their 3 tasks and complete a survey about their experience. Figure 3 and Table 1 show the median scores and averages that volunteers, nonprofits, and professionals in each condition gave to: (a) the quality of work produced; (b) how much a particular task helped volunteers to produce relevant work for their portfolio for their professional goals; and (c) how much the volunteer work helped nonprofits. Volunteers responded all 3 survey questions based on their personal experiences; professionals only responded questions on work quality and professional goals; and nonprofits about work quality and helping nonprofits. To adequately respond to the survey questions, professionals were presented with the goals of each volunteer they evaluated; and nonprofits were given the general goals of each organization for which volunteers did tasks. Everyone also gave written feedback to their responses.

For each of the survey questions that volunteers, nonprofits, and professionals responded, we also ran two sided t-tests. The t-tests help us to test for differences in the perspectives people had of the work volunteers produced work when using each particular interface.

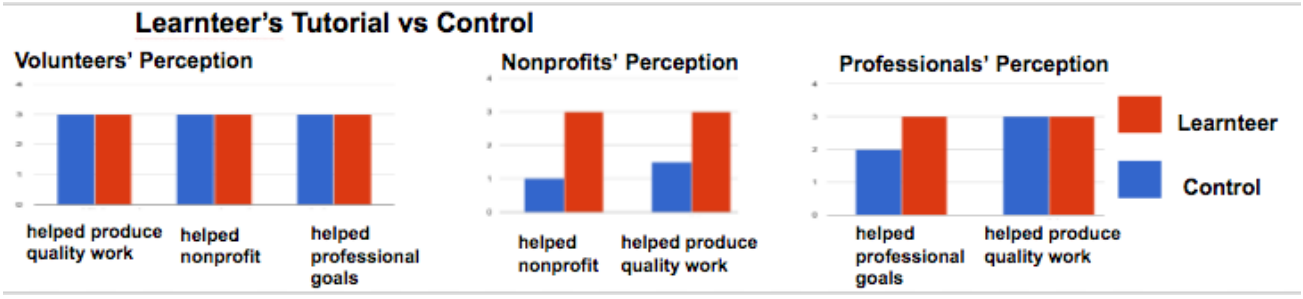

Figure 3. Summary of results from Study 1: overall nonprofits and professionals considered Learnteer's Tutorials helped volunteers more than the control interface to produce higher quality work that better helped nonprofits and the volunteers' professional goals.

	Mean Learning	Median Learning	Mean nonprofit	Median nonprofit	Mean Job Goals	Median Job Goals
Volunteers Control	2.9	3	2.5	3	2.8	3
Volunteers Learnteer	2.7	3	2.8	3	2.8	3
nonprofit Control	2.1	2	2.5	2	–	–
nonprofit Learnteer	2.8	3	2.9	3	–	–
Professionals Control	1.8	2	–	–	2.5	2
Professionals Learnteer	3.2	3	–	–	3.1	3

Table 1. Summary of Results from Study 1: Inspecting Learnteer's Tutorials

	T Test Value
Volunteers: Learning	t = 1.38 (p=0.16)
Volunteers: Help nonprofit	t =-0.5 (p=0.59)
Volunteers: Help Professional Goals	t = 1.9 (p=0.05)
nonprofits: Help Learning	t =-3.10 (p=0.003)
nonprofits: Help nonprofit	t =-2.73 (p=0.008)
Professionals: Help Learning	t = 1.38 ($p < 2.2e\text{-}16$)
Professionals: Help nonprofit	t =15.44 ($p < 2.2\ e^{-16}$)

Table 2. Results from two sided t-tests

Table 2 presents an overview of the results. In the case of volunteers, our results did not reject the null hypothesis that there was a statistically significant difference between the control interface and Learnteer. Upon manual inspection of responses it seemed volunteers felt that producing quality work while on their own was more challenging than when receiving guidance. However, this challenge prompted volunteers to investigate more. Being forced to construct their own knowledge likely led volunteers to feel that they were producing quality work that was of the same quality as if they had received the system's guidance.

For the case of nonprofit leaders and professionals, we found there was a statistically significant difference between the scores given to the control group and to Learnteer. Our hypothesis was thus supported: professionals and nonprofits considered that volunteers produced higher quality work, helped nonprofits more, and advanced their professional goals more when using Learnteer's tutorials.

Study 2: Evolving Interface to Present Useful Tips

Here we analyze how effective Learnteer's Evolution (interactive tutorials that learn the tips to show to volunteers) is for: (1) obtaining quality deliverables; (2) helping volunteers increase their opportunities to get a good job ; and (3) generating useful work for nonprofits.

Method

To study the effectiveness of Learnteer's Evolution we conducted a between-subjects study exposing one group of volunteers to Learnteer's Evolution, while another group was exposed to Learnteer's normal tutorials interface (without evolution).

Participants

The same criteria as in Study 1 was used to recruit volunteers, professionals and nonprofits. task. We recruited 30 volunteer participants, 30 nonprofit leaders, and 30 professionals. We aimed for volunteers in both groups to have similar goals.

Procedure

A similar procedure to study 1 was performed. Note, however, that here volunteers under the evolved version were displayed useful tips at the top of their screen when they selected a particular task to do. The evolved version showcased to volunteers the best advice when they reached their last task. The tips that the evolved version presented were tips that came from Learnteer's Eliciting Tips Interface. Participants in both conditions waited 20 min between tasks to wait for the external tips.

Results

For each of the survey questions that volunteers, nonprofits and professionals responded, we also ran two sided t-tests. Table 4 presents an overview of the results. For almost all cases (except for how much volunteers felt they helped nonprofits), we found there was a statistically significant difference between the scores given in the Learnteer's Evolution group and Learnteer's normal tutorials. In general, volunteers felt that they produced higher quality work and served their professionals goals more when working under Learnteer's normal interface than the evolved one. Upon manual inspection of feedback given by volunteers it seemed participants felt that they were under more pressure when working

Figure 4. Summary of results from Study 2: overall nonprofits and professionals considered Learnteer's Tutorials with Evolving Tips helped volunteers to produce higher quality work that better helped nonprofits and the volunteers' professional goals.

	Mean Learning	Median Learning	Mean nonprofit	Median nonprofit	Mean Job Goals	Median Job Goals
Volunteers Tutorials	2.7	3	2.8	3	2.5	3
Volunteers Evolved	2.7	3	2.5	2	2.2	2
nonprofit Tutorials	2.8	3	2.9	3	–	–
nonprofit Evolved	3.2	4	3.5	4	–	–
Professionals Tutorials	3.2	3	–	–	3.1	3
Professionals Evolved	2.6	3	–	–	2.9	3

Table 3. Summary of Results from Study 2: Inspecting Learnteer's Tutorials with Evolving Tips

	t-test Value
Volunteers: Work quality	t = 2.18 (p=0.02)
Volunteers: Help nonprofit	t = 1.08 (p=0.28)
Volunteers: Help Professional Goals	t = 3.78 (p=0.0002)
nonprofits: Work quality	t = -3.27 (p=0.001)
nonprofits: Help nonprofit	t = -2.29 (p=0.02)
Professionals: Work quality	t = -4.69 ($p < 1.2\ e^{-5}$)
Professionals: Help nonprofit	t = -2.83 (p=0.005)

Table 4. Results from two sided t-tests

under structured work mixed with tips from nonprofits and professionals. This pressure seemed to make them feel that they were producing low quality work that was not helpful for their professional goals.

For the case of nonprofits and professionals we found that our hypotheses were supported: nonprofits considered that volunteers using the evolved tutorials produced higher quality work, and produced work more useful for nonprofits. Similarly, professionals considered that volunteers using the evolving interface condition produced higher quality work and produced work that served their professional goals more.

DISCUSSION

Our evaluation of Learnteer suggested that by providing guided volunteerism interfaces that evolve we can lead volunteers to produce higher quality work than when using traditional tools.

There are several benefits related to improving the pipeline and execution of volunteer work:

i) It could help volunteers to more effectively pick up and learn new skills [16]. Imagine systems that can guide volunteers to now not only produce quality work, but also ensure that volunteers understand the concepts and context behind what they are doing to produce work similar to experts.

ii) It could reduce dropouts. Recall that one of the main reasons why people leave is that volunteering rarely offers ways to grow over time. Structured volunteerism can offer great learning opportunities to volunteers, which might help retain them long term. Tackling the problem of volunteer dropouts is important because dropouts directly impact the lifespan of a nonprofit [8], especially as how long a nonprofit exists depends on how long the nonprofit's major contributors stay involved. Dropouts also affect how rapidly a nonprofit can tackle problems, as having dropouts means the nonprofit needs to spend time on new recruitment.

Note also that by systematically providing guidance to volunteers, Learnteer can free nonprofits from having to prepare extensive tutorials for the volunteers themselves. Nonprofits in general only have to provide small tips and occasional feedback on the work produced by volunteers. Learnteer's model can thus provide nonprofits with more time to help the community.

Learnteer was able to fulfill its objective: it helped volunteers produce higher quality work than traditional interfaces according to experts from industry and from nonprofits. However, despite this, we found that, surprisingly, volunteers themselves did not feel any significant difference between executing work with Learnteer's tutorials and executing work without them. Upon manual inspection of the feedback from participants it seemed that volunteers preferred to execute the work without the tutorials because this forced them to investigate more. Volunteers likely felt they were producing work of higher quality when they understood what they were doing in more detail. Research in crowd work had found that tutorials [6] and other guided approaches [7] were effective for making workers feel that they had produced quality work. We believe that we saw a different phenomenon on Learnteer because volunteer tasks were likely more motivating than tasks on crowdsourcing platforms. This might have made people go the extra mile to complete the task, regardless of the sup-

port they received from the system. As a result both volunteer groups felt they produced similar quality work.

Volunteers seemed to believe they were more effective on Learnteer's normal interface that lacked evolution. Upon manual inspection of the feedback it seemed that participants might have felt more stress with the tips (even though they performed better). For instance, one of the volunteers commented: *"I do not understand the need to put us through so much pressure while making this document."* Perhaps too structured work flows might create excessive pressure on volunteers, making them feel like they cannot act freely.

Our results highlight an interesting design space for platforms that systematically coordinate volunteers to produce quality work: How do we design interfaces that provide freedom to volunteers while still helping them to produce high quality volunteer work? Future work could explore volunteer interfaces that provide freedom to volunteers while still ensuring task quality. Note that a way that Learnteer's model might be improved is by also taking into account direct feedback from volunteers as they work. Here Learnteer might follow designs similar to AXIS [20] that leveraged the learners themselves to identify what explanations to present.

Limitations

The insights from this work are limited by the methodology used and population studied. We conducted our experiments in a closed field experiment. While we tried to recruit a wide variety of real volunteers, real nonprofit leaders, real professionals, and we had real volunteer tasks from volunteering platforms, our results might not yet be generalized to populations at large. Future work could study how Learnteer's tutorials and evolving tips play out in the wild to better understand the phenomenon and dynamics. Note also that our methods focused on breadth instead of depth. Future work may involve longitudinal studies and engage in in-depth interviews with volunteers, nonprofit leaders, and professionals.

CONCLUSIONS

We introduced Learnteer, a system that builds structured pipelines for volunteering to produce higher quality volunteer work that is more helpful for nonprofits and that also helps volunteers obtain better job opportunities than traditional volunteering interfaces. Learnteer introduces evolving tutorials that learn through time the most useful tips to show to volunteers. Field experiments provide evidence that Learnteer's evolving tutorials lead volunteers to produce higher quality work from both the standards of nonprofits and the industry.

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