End-Users vs Software Practitioners: Recruitment Challenges and Strategies in Software Engineering Research

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***Abstract*—This paper shares insights from our first-hand experience with key recruitment challenges encountered in software engineering research, focusing on two distinct participant groups: end-users and software practitioners. By conducting a reflective analysis, we emphasise the particular challenges we faced when engaging these groups during empirical study recruitment phases. Significant challenges we faced in recruiting end-users include *ensuring authenticity*, *maintaining engagement*, *achieving demographic diversity*, and *addressing privacy concerns*. Conversely, we faced different challenges when recruiting software practitioners, including *sourcing the right expertise*, *utilising online recruiting platforms*, *navigating time constraints*, *aligning incentives*, *obtaining a representative sample*, and *coordinating with remote and distributed teams*. By detailing the strategies we employed to address these challenges, this paper contributes practical knowledge to enhance the efficacy and inclusiveness of research practices, ultimately fostering more robust software engineering research outcomes.**

***Index Terms*—User Recruitment, Software Engineering, Project Management, Agile Methodologies, Software Practitioners**

I. Introduction

In empirical software engineering research, the recruitment of participants plays a crucial role in the validity and success of the studies. However, the recruitment process for participants, such as diverse end-users and software practitioners, presents unique challenges that can significantly affect research results [1]–[4]. This paper discusses these recruitment challenges by examining our prior experiences in engaging two distinctly different groups: end-users of mHealth applications [5] and software practitioners actively working in the software industry (predominantly work in RE) [6]–[8] . Both mHealth end-users and software practitioners are integral to the software development life cycle (SDLC). Software practitioners are involved in the design, development, maintenance, and management of software systems, while end-users are the consumers of the final product. Given the vast diversity among end-users, this study focuses on mHealth end-users as a specific case study to illustrate the broader challenges and strategies in recruiting participants for research studies. This connection underscores the importance of understanding and addressing the unique needs of both groups to improve the overall effectiveness of the SDLC. Our research spans a variety of methodologies such as focus groups, surveys, interviews, and observational studies. Each method posed unique challenges, and we detail the strategies we employed to address these issues or propose potential solutions to mitigate them. Our research particularly emphasises *online recruitment*, and due to the COVID-19 pandemic, we have transitioned our most of user studies from in person to *online formats*.

End-users provide essential insights that are critical to creating user-focused solutions. However, the recruitment of end-users for research poses substantial obstacles. Verifying the *authenticity of participants* is challenging, particularly when financial incentives are used, which can attract those who may not be eligible as per the selection criteria [2], [9]. *Maintaining study interest*, especially among the elderly or those with limited technology skills, we have found can often result in minimal participation [10]. The ability to *reach diverse populations* is compromised by language barriers, varying levels of literacy, and the digital divide [11]–[13], while *concerns about privacy* deter the disclosure of personal data [14]. Overcoming these issues is vital to enhancing recruitment methods and securing a varied and active group of end-user participants.

Software practitioners' involvement is often *constrained by limited availability*. They have varying *levels of interest* in research participation and place more importance on *technical outcomes*. Furthermore, in today's era, due to the fast-paced nature of the software industry, obtaining industry participants and *sustaining them throughout* the research studies, especially longitudinal studies, can be particularly challenging, as they often tend to prioritise their job-related project timelines and workloads. Hence, by exploring these recruitment challenges through the lens of our recent experience, this paper aims to provide a comprehensive overview of the strategies that have proven effective, as well as ongoing challenges that complicate participant engagement in software engineering research.

Recruiting participants for empirical research studies presents distinct challenges, especially when comparing the

needs of end-users and software practitioners. *Ensuring authenticity* is more complex with end-users due to the allure of monetary incentives, while verifying the professional experience of software practitioners requires methods like certifications and work history checks. *Engagement and retention* strategies differ significantly as end-users need simpler communication and visual aids to remain engaged, while software practitioners require flexible scheduling, clear relevance to their professional work, and different explanations on the *research topic* depending on their areas of expertise. *Privacy* concerns are handled differently among software practitioners and end-users, depending on the boundaries and types of experiences they share. Customising recruitment and engagement strategies to these distinct needs is essential for the efficacy and inclusiveness of research practices, leading to more robust and user-focused outcomes.

The rest of this paper is structured as follows. Section II explores the challenges and strategies involved in recruiting end-users. Section III examines the challenges and strategies for recruiting software practitioners. Section IV discusses the main differences between end-users and software practitioners regarding various challenges in the user recruitment process. Section VI concludes the paper.

II. Challenges and Strategies When Recruiting End-Users

Recruiting end-users for software engineering research studies presents distinct challenges due to the diverse backgrounds of end-users, their varying levels of technological expertise, and the specific nature of the research study. We have recruited end-users globally for various research methods, including surveys, interviews, and focus group studies, and have encountered several major challenges along with strategies to address them or potential ways to overcome them.

A. Diverse Participant Motivation

A common issue faced in the recruitment of participants is the challenge of confirming their *authenticity*. For example, one of our studies needed to include participants who 1) suffer from a specific chronic disease or are actively preventing such conditions and 2) have experience using mHealth applications [5]. Thus, we required participants to positively answer both of these critical questions to proceed with a focus group participation, as shown in Figure 1. Although we initially believed that these stringent selection criteria would limit participation when we advertised our study on social media platforms, we were thrilled to receive 96 registrations for the focus group study. We proceeded to confirm their availability and had them sign the consent forms.

In the first focus group study, we had three participants who self-identified as being from different countries with different kinds of chronic diseases. However, during the virtual session, all participants had their cameras turned off and used names different from those they had registered with. When we asked questions, they seemed unfamiliar with their names and barely responded. Their input during the focus group was insufficient, and they exhibited minimal understanding of the subject matter, which they had claimed to be familiar with in the registration form. Due to these problems, we reviewed approximately 100 registration responses from the focus group study and chose to discard all original study registrations and begin the recruitment process anew.

This issue was also observed in another end-user study in which researchers shared their screen and granted the participant keyboard and mouse control via Zoom [1]. They identified several inconsistencies between the demographic information collected in the screening questionnaire and the responses given during the online session. This led them to conclude that the participants might have provided false information on the pre-screening questionnaire and subsequently forgot what they had originally submitted.

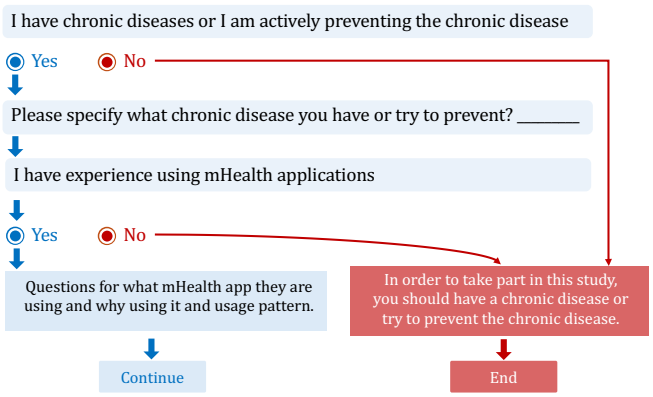

Fig. 1. Selection criteria of the mHealth end-user study [5]

Verifying the authenticity of end-user participants to ensure that they meet specific criteria is a major challenge in empirical research studies. This issue becomes particularly pronounced when monetary incentives are involved [2]. We postulate that our study outlined above had encountered a substantial number of questionable participants because our initial study advertisements promoted a monetary incentive of US$20 Amazon voucher for a one-hour focus group session. The use of monetary incentives is a common practice in health-related research and is often used as a strategy to increase participant enrolment [9]. Additionally, some researchers see this as a necessary token of appreciation to acknowledge the time participants dedicated to the study. Previous studies have shown that financial rewards can effectively increase participation rates, especially in difficult-to-recruit populations [15], [16]. However, while these incentives can help to achieve the desired sample size, they also have notable drawbacks that need to be carefully managed. Monetary incentives can attract people who are not genuinely eligible for the study but are primarily motivated by the financial reward. These individuals may provide false information to meet eligibility criteria, compromising the integrity of the study data. When participants are motivated solely by incentives, they can provide poor-quality data, compromising the reliability and validity of the research findings. The option to join studies through virtual platforms

also encourages participation from regions where even modest monetary rewards serve as substantial incentives.

Another issue for participants motivated by financial incentives is that they might *tell researchers what they think the researchers want to hear instead of the truth*. In one of our studies with end-users, several participants voluntarily joined without accepting the voucher, preferring it to be used for other purposes. These four participants provided more *negative feedback* on certain aspects of the technology presented during the user study session. For instance, they questioned the usefulness of the design in the prototype and expressed that they did not see its value in their daily use. Interestingly, these participants joined the session much earlier than others who even happened to drop out during the session. They also had more questions about why we designed such solutions, what our future plans are, and reminded us to keep them updated on the project's progress. It is crucial to recognise that the motivation of a participant, as those involved solely for financial incentives, will always differ from those whose aim is to contribute to the research for scientific purposes [17]. Providing significant financial rewards can also pose ethical issues. It may improperly *persuade individuals to take part in studies they would usually avoid*, especially if the research focuses on sensitive subjects or involves vulnerable groups. [2], [18]

In our study, we used the following strategies to address the problems caused by potentially fraudulent participants:

- **Stringent Screening Processes:** Stricter screening techniques, involving multiple stages, necessitating participants to submit further proof of their eligibility, such as professional credentials for studies requiring particular expertise [19]. However, if participants have already invested time in the study and completed demographic forms, only to be found unsuitable and subsequently excluded, this can raise some *ethical concerns*. In such scenarios, we clarify our reasons for exclusion clearly, stating that their background does not align with the required profile, along with an apology for the inconvenience. After identifying unsuitable participants, we also refined the *selection questions* related to skills or experiences to more effectively filter out unsuitable individuals (end-users).
- **Non-Monetary Incentives:** Non-monetary incentives can still motivate participation while minimising the risk of attracting individuals who are solely interested in financial gain. Research indicates that individuals are willing to participate in studies without monetary compensation [20]–[22]. Data collected from these self-motivated participants can be of comparable quality to laboratory data and may even surpass the quality of data from participants who receive monetary rewards online [23]. Examples include providing health-related resources, such as informational brochures and wellness guides. Participants may also be motivated by access to the product being studied, discounts, or free trials for related products, and entry into prize draws for gadgets or relevant items. Certificates of participation, access to study results, and community perks such as event tickets or local resource access, along with the chance to contribute to scientific research or public health, can inspire individuals motivated by social responsibility.
- **Delayed Incentive Disclosure:** Revealing financial rewards after the confirmation of initial eligibility helps to retain the participants, who are truly interested and meet the criteria, beyond the preliminary screening phases. In our following interview study with users, the monetary incentives *were not publicised until prior to the signing of the consent form*. Investigating the dimensions and amount of different reward systems and their effects on behaviour presents a promising direction for future studies [24], [25].
- **Engaging Trusted Networks:** The systematic review by Ko et al. [26] found that the majority of studies recruited participants through pre-existing relationships. In subsequent phases of our study, we took the approach of engaging new participants via reputable networks, such as healthcare organisations. This involved anonymous hospitals and specialised facilities like the anonymous diabetes clinic. Additionally, we collaborated with various community organisations and Non-Governmental Organizations(NGOs), including local community groups and organisations focused on heart disease, dementia, stroke, and kidney-related issues. These organisations supplied authentic participants who satisfied the study's requirements.

B. Participant Engagement and Retention

Maintaining participant interest throughout the study period presents significant challenges, particularly when dealing with older participants who may not be very familiar with technology [3], [27]. One challenge is the lack of *channel experience* [27], [28], such as using online platforms. For example, for one of our studies [5], we observed that participants frequently encountered problems joining the Zoom meeting, turning on their cameras, or clicking on links in the Zoom chat. Often, we needed to step in and help them navigate these challenges. Secondly, some participants have less *experience with discussion topics* [27]. These participants often struggle to understand certain concepts that are discussed during focus groups or interviews. Consequently, they may not see value in demonstrations, leading to disengagement and a reluctance to complete any post-session activities [10].

To address these challenges and improve engagement and retention, we have implemented the following strategies:

- **Simplified Communication:** We ensured that all forms of communication, spoken and written, are straightforward and easy to understand for all target participant groups. We piloted the instruments and the technologies to use with representative participants. We substituted terms such as *"adaptation"* with *"changes on the user interfaces"*. As users found it challenging to navigate through the prototype we provided, we included visual supports like flow charts and guidelines to clarify complex ideas. We also made *a simple video* to explain certain steps and concepts. Using demonstrations and examples that draw parallels

to the discussed topic can also support the participant's comprehension of the topic.

- **Enhanced Interaction:** The structure of focus groups and interview sessions can also be used to maximise interactivity. Including interactive activities such as hands-on demonstrations by developing a simple prototype for users to engage with can enhance interaction. Regardless of how much we stressed to participants that there are no correct or incorrect answers, they initially felt *pressured* to grasp certain technologies or terminologies. Experiencing early success can assist participants in feeling more comfortable in the setting and more inclined to verbalise their thoughts. It can be beneficial for researchers to start with simple interactive activities, such as prompting users to share their relevant experiences [27].
- **Keep in touch:** Maintain regular communication with participants between sessions. This should include progress updates, additional materials, and announcements regarding upcoming user study sessions. End-users have been kept informed about our study's progress and outcomes through frequent updates.

C. Ensuring Diverse Participant Demographics

Equitable subject selection requires that the scientific objectives of the study be the main criteria for choosing groups and individuals [29]. It is ethically and scientifically necessary to ensure that research studies include sufficient participants from *different socio-demographic groups*. Nevertheless, difficulties in engaging a diverse demographic of end-users continue to exist [11]–[13]. Obstacles such as language barriers, literacy levels, and the digital divide hinder the participation of certain demographics [30], [31]. Furthermore, varying cultural backgrounds can influence how people view and react to recruitment strategies and participation in the study [31]. During our user study [5], the strategies employed for recruitment, including advertising on social media, in healthcare facilities, and at academic institutions, led to most participants having a *university degree*. As a result, the extent that these samples reflect disparities in technological access instead of the true diversity of chronic disease user groups, it limits the generalisability of the research findings.

To address these challenges and improve engagement and retention, we have implemented and considered the following strategies:

- **Flexible Participation Options:** Where feasible, provide various participation options for the study, including online surveys, telephone interviews, face-to-face meetings, and post questionnaires. This variety helps meet diverse accessibility and preference requirements. For example, our research encompasses focus group studies, surveys, and interviews, all addressing similar topics. Participants may choose one method to engage with our study, while others might participate in multiple methods, such as first completing the survey and subsequently taking part in an interview.
- **Community-Based Participatory Research:** The premier approach for enhancing diversity in study samples and creating fair research designs is Community-Based Participatory Research (CBPR) in the field of psychology research [32]. In this cooperative method, community members are directly involved in the research process, collaborating with researchers to establish the research question, develop and execute the research methodology, and analyse and share the results [32]. Given the time constraints for our project, we were unable to fully implement this research approach. Instead, we connected with participants through various organisations and communities, building initial relationships before seeking their interest in our study. For example, an author involved in our study participated in a group discussion related to chronic diseases in local communities, where she interacted with attendees to gauge their interest in our research. In addition, she attended conferences, discussing her research with attendees, who then voluntarily joined the research study.

D. Privacy and Ethical Concerns

The sensitive nature of health-related research often makes participant recruitment challenging. We started promoting our study via various social media channels, a popular practice in health research [33]. These platforms have a wide reach, allowing us to access large, diverse populations and small, difficult-to-reach subgroups with sensitive or uncommon health conditions [34]. However, this approach introduces distinct ethical dilemmas, particularly because personal data on social media could be *collected or identified from individuals without their awareness or consent* prior to participation in the study [14].

For example, when promoting our study in online health groups on some social media, some potential participants expressed concerns about how we obtained their information and questioned the legitimacy of our recruitment posts. In addition, potential participants face difficulties in differentiating genuine messages from spam and such misleading information on the Internet [35]. Another obstacle for researchers who want to use the Internet and social media for recruitment is the varying standards regarding what constitutes ethical or ***"sensitive"*** personal information across different research communities [36].

In addition to privacy concerns when recruiting participants via social media, we also noticed privacy issues during virtual focus group studies where participants were unfamiliar with each other [37]. They tend to be less willing to share personal information in these sessions. Despite emphasising in the consent form that *"☑ I agree to maintain the confidentiality of the information discussed by all participants and researchers during the focus group session."* and reiterating the ground rules at the beginning of each session, we still observed a clear hesitation when the discussion touched on their daily challenges related to certain technologies, unlike in individual interviews. This occurs more frequently in focus group research because the dynamic of the group is influenced by the participants themselves. They may raise topics that

were not planned or anticipated by the facilitator, making it difficult to steer the conversation away from subjects that some participants find uncomfortable [37].

We have been exploring the following strategies for recruiting participants through social media to address these challenges:

- **Online Presence**: Create a well-designed and informative study website that offers detailed information about the research, its objectives, and the participation procedure. Utilise verified social media accounts to share recruitment information. Verification improves credibility and helps differentiate authentic communications from spam. Additionally, hosting the website under a university domain provides assurance to participants about the legitimacy of the research.
- **Apply Privacy-Preserving and Ethical Practices**: Foresee privacy-invasive incidents before they arise—prior to individuals being exposed to the recruitment strategy [38]. Researchers should continuously monitor privacy and ethical concerns throughout the user study session. For instance, when participants provide their *consent*, the researcher can offer comprehensive and clear information to help focus group participants set realistic expectations for the discussion. The purpose of the focus group can be outlined, including examples of the questions to be posed. During the *briefing*, establish and agree on a set of ground rules just before the discussion begins. The researcher can highlight the public nature of the focus group, stress the importance of confidentiality and anonymity, and offer guidance on topics that might be inappropriate to discuss, considering the previously mentioned caveats. While *conducting* the focus group, the facilitator should be vigilant for signs of distress, breaches of confidentiality, or oversharing, and steer the conversation in a different direction if necessary. During the *debriefing*, the facilitator can reinforce key points about confidentiality and anonymity, and address any sensitive or problematic issues that arose during the discussion, if it was not suitable to do so at the time.

Summary

Challenges in recruiting end-users include verifying authenticity, keeping them engaged, ensuring demographic diversity, and addressing privacy issues. Strategies have been developed to tackle these challenges.

III. Challenges and Strategies in Recruiting Software Practitioners

Recruiting software practitioners for software engineering research studies presents its own diverse challenges, different from the end-users. These challenges occur due to the specific nature of their work, their professional environment, the nature of the research study, and the general conditions for conducting research within the industry. We have recruited software practitioners worldwide for diverse sets of research studies and methods, including surveys [6], in-depth interviews [7], and software team observations [8]. The following are some major challenges we faced when recruiting participants for these studies and the strategies we used to mitigate these challenges.

A. Expertise Diversity

Software teams consist of diverse roles including developers, testers, business analysts, project managers, and UI/UX designers, each specialising in different aspects of the development process. The variety of roles and responsibilities can make recruitment more challenging because researchers must verify that participants possess the necessary *domain knowledge, specific technological expertise, or considerable practical experience*. This issue is further intensified by the challenges noted in the literature regarding the selection of a representative group of software practitioners [39], [40]. Hence, one of the major challenges in recruiting software practitioners is to find practitioners with the ***right expertise*** needed for the study.

For example, we conducted a survey study and in-depth interviews focusing on requirements engineering work in software teams, as we wanted to know their perspectives on the influence of human aspects on RE [6], [7]. To do this, we had to pay extra attention to ensure that participants possess the necessary experience in Requirement Engineering (RE), as the data gathered from individuals who primarily work outside of RE may not provide accurate insights. This challenge is further compounded by the fact that *roles within software teams often overlap* and their extent of involvement in RE can vary significantly, even with practitioners with similar job titles. For example, while some software engineers indicated that they are often involved in all sorts of RE-related tasks, others highlighted that they are rarely engaged in RE tasks or are only involved in limited tasks, such as requirements validation or management.

To mitigate these challenges, we used various strategies including:

- **Detailed Pre-screening Process:** When designing the survey, we made sure to add a set of questions specifically designed to indicate their involvement and experience in RE which helped us identify the exact participants we required for the study. For example, by asking a simple question on whether they are involved in RE tasks and types of RE tasks, and asking them to elaborate on their job responsibilities, we could identify the group of practitioners we need for the study while preventing non-eligible participants from completing the study.
- **Tailored Recruitment Messages:** When looking for practitioners involved in RE, we used tailored recruitment messages highlighting that it is specifically for RE. We ensured to emphasise this in our promotional materials such as flyers, social media updates, LinkedIn communications, and emails to draw the attention of practitioners who are both qualified and interested in our research.

- **Engaging Professional Networks Forums:** When recruiting participants for our interview study, we looked for online forums and social media groups catering to software practitioners particularly those who work in RE. This approach enhanced our ability to find the right participants by connecting with relevant professional communities.
- **Peer Recruitment/Snowballing:** We requested our participants to share the study with their peers. This peer recruitment approach proved highly effective in expanding our reach within the professional community by leveraging existing trust and relationships among colleagues. This method is particularly advantageous in fields where potential participants are interconnected and can recommend peers who meet the study's criteria [3], [41].

B. Software Developer Time Constraints

Software practitioners face tight deadlines and often have very demanding project delivery schedules. Hence, finding time to participate in empirical research studies can be a significant hurdle, as it may *not be seen as a work priority, but rather as a voluntary interest area*. This can make it a critical barrier to recruitment and participation in research studies. For example, when reaching out to software practitioners to participate in our interview study [7], via our personal networks and social media platforms, their time constraints were the key reason for rejecting our invitations. Their daily schedules were packed with development tasks, meetings, and given the high workload, finding additional time for an interview study, which takes a minimum of 30 minutes from their schedule was very difficult, in spite of them being interested in participating in our study. One of the project managers even stated that it was difficult for them to provide a time slot for the next six weeks as their project was going live.

The following strategies helped us to effectively overcome the time constraint challenge in our studies:

- **Flexible Participation Options:** For practitioners interested in our interview study who found it difficult to allocate time due to their workload, we offered flexible scheduling options including participation outside of standard working hours such as early mornings, late evenings or weekends. Additionally, the study also included a personality test that was designed as an online survey. This format allows participants to complete it at their convenience, significantly reducing the barrier of fixed scheduling.
- **Minimising Time Commitments:** Reducing the time commitment for participants helps to successfully recruit software practitioners. When designing our survey and interview studies, we prioritised efficiency to ensure that we could collect essential data without imposing heavily on participants' time. For extended studies, dividing the required time into smaller, manageable segments has proven effective. For instance, our interview study included a pre-interview questionnaire that took approximately 10 minutes to complete to gather basic demographic and work-related information through closed-ended questions. We distributed it online as soon as participants consented, to complete it at their convenience. This strategy allowed us to omit these preliminary questions during the actual interview, focusing directly on the core questions, which maximised the effectiveness of the time spent with each participant.

C. Privacy Concerns of Developers and Organisations

Certain study participants might be hesitant to engage in sensitive research. For example, software professionals could be wary of participating in a study that scrutinises their personal work practices or performance, due to concerns about possible *consequences or judgements from their employers* [42]. This is especially worrisome for individuals who may worry about their *personal privacy being jeopardised*. The study could also delve into highly personal areas, such as personality evaluations, motivation, opinions, or performance, which participants might worry could result in judgements or biases against them if discovered. This was evident during an observational study aimed at examining the impact of personality when doing RE-related activities [8]. The study required participants to complete a questionnaire assessing various personal attributes, which led to initial resistance among team members. They expressed concerns about being judged based on these personal characteristics, fearing that such judgements might influence their professional reputation or interpersonal relationships within the team. To address these concerns, we undertook several presentations and one-on-one meetings to clarify the nature of the data collection and the handling process, establishing trust with potential participants. However, this can be difficult when researchers do not have an existing relationship with the software teams.

We used the following strategies to overcome these challenges:

- **Enhanced and Emphasised Confidentiality Measures:** In our studies we emphasised using anonymous identifiers, ensuring secure data storage and limiting access to the data to the research team. However, during the observational study [8], we had to take extra measures such as conducting presentations to the team lead, sharing detailed study design with the team and one-on-one meetings with the team members who had concerns to clearly communicate how and when the personality test was analysed, and what are the things we are going to observe to avoid their feeling of being judged. We emphasised that the analysis of personality tests would be deferred until after the six-week observation period, assuring participants of their privacy and the non-judgemental nature of the research. Further, we assured the team members that their responses would not be used to evaluate them as individuals or impact their professional status.
- **Empowering Participants with Greater Control:** During our studies, we also offered participants more control over their involvement in the research. For example, they could opt out of certain parts of the study, such as not

participating in the follow-up interviews after the observational study, reviewing and adjusting their interview transcriptions and withdrawing their participation before we anonymised the data.

D. Use of Online Recruitment Platforms

Researchers may utilise various recruitment platforms to engage software practitioners in their studies. Examples include Prolific[1], Amazon Mechanical Turk (MTurk)[2], Positly[3], and Respondent[4]. Despite the availability of these diverse platforms, the recruitment of qualified and credible software practitioners remains a significant challenge within the software engineering community [43] [44]. Researchers across various domains, including software engineering, have shared their experiences using these platforms, comparing and highlighting the difficulties of recruiting participants for their studies [45] [46] [47] [48]. In our studies, we have employed Prolific and Amazon MTurk to recruit software practitioners. We encountered several challenges, including difficulties in finding the *specific experts or roles required for our research*, dealing with participant *diversity* that introduces noise into our sample pool, and the necessity of pre-screening participants to ensure quality data collection.

For example, when we used Amazon MTurk for a survey [6], more than 50% of the initial responses came from specific countries or regions. This resulted in the need for explicit exclusion of these regions/countries from subsequent batches to achieve a balanced participant pool. Additionally, observing the answers to our open-ended questions revealed that the same set of participants might be completing the survey multiple times, likely motivated by the payment. These participants often listed diverse job roles but provided similar experiences in a similar writing pattern in the open-ended questions.

In one of our survey studies requiring experienced practitioners currently working in the industry via Prolific, we faced the risk of recruiting actual software engineers. Despite using pre-screening questions, students and undergraduates with little or no experience filled out the survey. Upon contacting the platform, we discovered that some participants might lie about their qualifications to gain access to studies, usually motivated by the payment. We found that these two participants confessed to being students when they filled out the survey under their claimed job role, rendering their responses invalid for our research, although we still had to compensate them. Such situations introduce additional noise into data collection, underscoring the importance of careful observation of each response, in addition to pre-screening questions, to ensure quality data collection in research studies.

To effectively overcome the above challenge, we used the following strategies:

- **Geographic and Demographic Filtering:** We utilised the geographic and demographic filtering options provided by both Amazon MTurk and Prolific platforms to tailor our participant pool in our survey studies. For a survey like the one using Amazon MTurk, where over-representation and credibility of the participants from specific regions and countries were issues, setting geographic restrictions helped us to avoid such responses and balance the participant pool, eventually enhancing the representativeness and relevance of our findings.
- **Iterative Sampling and Data Verification:** We also used iterative sampling where initial data collected was used to refine and adjust the recruitment strategy such as filtering (e.g.; 10-20 batches). This approach helped us to identify and correct patterns of misuse such as the same participants attempting to take the survey multiple times. Coupling this with data verification strategies such as analysing the writing patterns or response styles in open-ended questions in the survey, their IP address along with their IDs in online platforms (e.g. Prolific ID) helped to identify discrepancies and ensure the credibility of the data collected.

E. Participant Incentive Misalignment

Researchers may provide incentives to their participants as a token of appreciation for their time spent on studies. These are often gift cards or online recruitment platform payments [5] [49] [50]. However, the effectiveness of these incentives is influenced by several factors including the specific participant group and the amount offered. As software engineering is considered to be a well-compensated profession, typical incentives like *small monetary rewards are usually not compelling enough* for them to participate in research studies and offering appropriate incentives that match the professional level and interest of software practitioners can be challenging [51], [52].

For example, in one of our survey studies, we used the Prolific platform to recruit software practitioners engaged in RE work [7]. We provided a 'fair' amount of payment per survey participant as suggested by the platform for our survey. We successfully recruited 50 participants. Upon submitting a paper on this work, we received reviewer feedback questioning the credibility of our participants, indicating that the incentives provided might not have been compelling enough to attract qualified individuals. To overcome this challenge, we used the following strategy:

- **Provide Value-added Incentives:** When it is challenging to provide appropriate incentives that match their professional level, value-added incentives such as exclusive access to research findings, and new software tools and technologies developed through research can be used as a strategy. For instance, in our survey study that featured a standard personality test, we offered participants the option to receive their detailed personality profiles upon request. This approach proved to be highly effective; the majority of participants expressed interest in obtaining their personality profiles, something they found novel and engaging. Additionally, this incentive sparked further interest among the participants, with some even volunteering for future studies to learn more about the ongoing research.

[1]https://www.prolific.com/
[2]https://www.mturk.com/
[3]https://www.positly.com/
[4]https://www.respondent.io/

This response underscores the potential of such value-added incentives to enhance participant engagement and commitment.

F. Remote and Distributed Teams

Software development often involves remote or globally distributed teams operating under hybrid work models. Coordinating participation across various time zones and setups introduces significant logistical challenges, particularly when conducting synchronous activities like interviews. Further, physically observing software teams becomes increasingly difficult under these conditions. With many practitioners working remotely, research methods must adapt, increasingly relying on virtual observation techniques. However, such methods can be *less immersive and informative compared to in-person observations*. In our RE practices study [8], the observational team primarily worked remotely, and all meetings were conducted online. Consequently, all our observations were made through Zoom meetings. This setup posed challenges in effectively observing how team members collaborated, particularly since our study focused extensively on the human-related aspects of software development. To mitigate this challenge we used the following strategy in our studies:

- **Maximised the Use of Available Resources:** When we used Zoom meetings in our observations, we not only observed live interactions but also captured them by recording these meetings with participants' consent. This approach allowed us to capture detailed interactions and communications during the meetings, providing a valuable repository of digital data that could be reviewed multiple times to extract nuanced insights and verify initial observations. To complement these observations and enhance the depth of our data, we conducted follow-up communications via emails and interviews. These interactions served to clarify any ambiguities observed during meetings and allowed us to engage directly with participants to explore deeper insights into their perspectives. Furthermore, individual follow-up interviews helped us to delve into specific aspects of our observations, providing a layered understanding of the team dynamics and ensuring that our data collection was as comprehensive and accurate as possible.

Summary.

Diverse expertise, limited time, privacy issues, misaligned participant incentives, and logistical complications with remote and distributed teams are the primary obstacles in recruiting software practitioners. Various strategies have been identified to overcome these hurdles.

IV. Discussion

The discussion section examines the distinctions in the challenges and strategies involved in recruiting end-users and software practitioners for research studies, ultimately offering insights into tailored approaches for boosting participant engagement and enhancing research outcomes. A comprehensive comparison is also shown in Table I.

A. Participants Selection

Ensuring the authenticity of end-users is challenging, particularly when monetary incentives are offered, as fake participants may claim eligibility for financial rewards, compromising data integrity. Multistage screening and requiring additional documentation can help verify authenticity. Similarly, this is a common challenge when recruiting software practitioners for research studies, specifically through online recruiting platforms, as they might not be ***real*** software practitioners. When using such platforms to recruit software practitioners, it is essential to go through pre-screen criteria such as using detailed filtering options that include professional experience, domain-specific, and technical knowledge [43]. However, this is more challenging when recruiting end-users as requesting additional information for filtering purposes can raise *privacy and ethical issues* [14], [38], especially when they have already invested their time in our research [19]. In one of our studies [5], prior to focus groups and interviews, we used a screening survey in which we enquired about the participants' country of residence. However, individuals may provide false information to gain entry into the study. Verifying details through IP checks, even with user consent, presents significant challenges. Furthermore, during iterative sampling and data verification, or multi-stage filtering, we might need to exclude some participants. In such cases, it is essential to provide a proper explanation and compensate them for their time while reassuring them about the handling of the information already collected [19], [34].

B. Engagement and Retention

Engaging older or less tech-savvy end-users is particularly challenging, as they may find some study concepts confusing and become less involved, leading to reduced contributions. Several challenges have been noted when involving older adults in user study sessions, such as significant issues with sustaining attention, being easily distracted by irrelevant details, and experiencing fatigue quickly [53], [54]. Adopting straightforward language, utilising visual supports, and performing regular check-ins are essential tactics for engaging older individuals.

Software practitioners often have packed schedules and tight deadlines and thus may find it difficult to allocate their time to participate in research studies. For extended studies such as observations, focus groups, and interviews, it can become particularly difficult for researchers to recruit and retain participants, as practitioners must prioritise their primary duties over research activities. Therefore, it is important to attract the practitioners' interest by emphasising the relevance and the benefits of the research study to their work, offering flexible participation options and clear communication about time commitments. Furthermore, performing *asynchronous*

TABLE I
END-USERS VS SOFTWARE PRACTITIONERS: COMPARISON OF CHALLENGES AND STRATEGIES

Categories	Types	End-Users	Software Practitioners
Participants Selection	Challenge	Guaranteeing authenticity and qualifications is difficult.	Verifying professional experience and knowledge is crucial to identify whether they are real software practitioners when recruiting via online platforms.
	Strategies	Multiple stages of screening, non-financial incentives, delayed disclosure of incentives, and engaging with trusted networks.	Detailed filtering options including professional experience, work history checks, and domain-specific and technical knowledge tests.
Engagement and Retention	Challenge	Ensuring engagement from older or less technologically adept users is challenging.	Software practitioners' packed schedules and tight deadlines.
	Strategies	Employing straightforward language, incorporate visual tools, and conduct regular check-ins.	Emphasising relevance to their work, offer flexible participation options, and clear communication about time commitments.
Varied Attitudes Towards Sharing Experiences	Challenge	End-users show limited interest in receiving transcripts and the specifics of what they share, leading to less detailed and reflective feedback.	Building the trust with practitioners related to the confidentiality of data collected.
	Strategies	Fostering a welcoming and interactive atmosphere that promotes unsolicited feedback	Emphasising the confidentiality measures taken by the research team and provide more control to the participants.
Varying Topic Experience	Challenge	End-users need more technical details to understand the topic and provide constructive feedback.	Proper explanation of non-technical terms and study context which are not familiar to the software practitioners, specifically in socio-technical research.
	Strategies	Ensuring that all communication, whether verbal or written, is clear and simple to grasp. Utilising demonstrations and examples that relate to the subject matter.	Providing supportive context details that include simple definitions and examples (e.g. social contexts, psychological context).
Varying Expectati Privacy	Challenge	Reaching out to end-users through various social media platforms can result in privacy concerns.	Professional groups often have elevated privacy concerns about the use of their personal and professional information.
	Strategies	Continuously monitoring privacy and ethical concerns throughout the user study session.	Emphasising the privacy measures taken by the research team and anonymising all the identifiable data prior to the data analysis.

activities, such as pre-interview questionnaires that allow them to complete at their convenience, can help engage software practitioners.

Engagement with end-users during research studies, specifically in a virtual environment, can be challenging for less tech-savvy people. For example, in our end-user study [5], we requested participants to assess their proficiency with Zoom and provided the resources to install or update Zoom if necessary. Additionally, we distribute the prototype link before the session to allow them to access and familiarise themselves with it beforehand. Although we provided resources in advance, none of the end-user participants examined the materials prior to the sessions; they chose to handle all tasks during the allotted session time instead of dedicating time outside the interview or focus group window. This suggests that asynchronous activity strategies may need to be adapted according to the participant group to potentially boost their engagement and improve the overall effectiveness of the sessions.

C. Varied Attitudes Towards Sharing Experience

There are notable differences in the way end-users and software practitioners approach sharing their experiences. These variations significantly impact the methodology of user studies and data management for each group. Software practitioners are generally open to sharing details about their perspectives, projects and experiences, but strongly prefer to keep the sensitive details about their organisations, projects and teams confidential. This preference for confidentiality could be mainly due to the competitive nature of the software industry and to avoid the potential risk of revealing sensitive information [55], [56]. Hence, it is important for the researchers to ensure how they are going to protect the confidentiality of the participants and provide more control such as the ability to withdraw their participation, providing transcripts (e.g., interviews or observations) to review and determine which information to be shared or removed. This will also be helpful in building trust between practitioners and researchers, encouraging them to participate in studies [57]. In contrast, end-users in our studies generally showed limited interest in receiving transcripts of their sessions [5]. They appeared to be less concerned about the specifics of what they share during the study, likely because the information shared is less sensitive and less likely to have significant personal or professional consequences. End-users tended to focus more on the usability and functionality of the products being tested and were more interested in providing immediate feedback during the sessions.

These varying perspectives suggest that different methods may be needed when conducting research studies for diverse groups of participants. For software practitioners, it is helpful to establish clear confidentiality protocols and provide the option to review and edit transcripts. Communicating this procedure from the beginning can address data privacy concerns and help practitioners feel more comfortable sharing their insights. For end-users, it is beneficial to create a comfort-

able and engaging environment that encourages spontaneous feedback. Researchers can focus on real-time data collection and analysis, ensuring that end-users understand the study's purpose and how their feedback will be used, which may enhance their willingness to participate actively.

D. Varying Topic Experience

It is essential for participants to have a comprehensive understanding of the research topic, as this enables them to reflect and share their thoughts and insights [58]. When participants grasp the research topic thoroughly, they can identify specific areas of interest or concern, draw on their own experiences, and suggest practical improvements, ensuring that the insights gained are meaningful and actionable for the researchers. Our diverse research studies indicate that software practitioners and end-users may require different kinds of explanations and information to engage effectively in research studies and share their insights. Software practitioners tend to prefer explanations that include nontechnical information to better understand the context. For example, in one of our interview studies [7] where we explored the practitioners' perspectives on the influence of personality on RE, we shared the basic definition and personality type examples with them while conducting the interviews.

In contrast, end-users generally need more technical information to understand the product. They usually concentrate on the software's functionality, the specific features it offers, and how these aspects align with their usage scenarios and benefit them. Providing each group with an appropriate balance of technical and non-technical information may help improve participant engagement and the quality of the feedback obtained.

E. Varying Expectations of Privacy

Recruiting participants for research studies frequently requires contacting through various communication channels, such as social networks, recruitment platforms, and personal networks of researchers. We identified that these methods could lead to notable privacy issues and these issues can vary depending on the group of participants, leading to various privacy concerns [36]. Comprehending and honouring these boundaries is essential to preserve trust and achieve effective recruitment and participation. Different groups of participants have *different perceptions and priorities when it comes to privacy*. Some people may find direct messaging via social media platforms such as LinkedIn or Facebook to be intrusive, while others consider it a convenient and acceptable means of communication. For example, software practitioners who are more familiar with digital communication might be more open to such direct approaches, while people with less experience with technology and social media may perceive unsolicited direct messages as a breach of their privacy.

Professional groups, such as software practitioners, often have elevated privacy concerns, particularly with regard to the use of their personal, professional and organisational information. They are cautious about sharing information about their projects or organisations which includes sensitive data. However, we have found that they are generally comfortable with direct contact on platforms like LinkedIn, where their professional experiences are already publicly available. In contrast, end-users, particularly those involved in health-related studies, may have notable privacy concerns due to the sensitive nature of their personal health information [59]. By recognising the unique privacy boundaries of various participant groups and implementing approaches such as clear communication, cultural awareness, and boundary respect, researchers can significantly foster trust and achieve highly effective recruitment.

Summary.

Key differences related to the challenges in recruiting end-users and software professionals include ensuring the authenticity of the participants, engaging the participants, addressing privacy concerns, and accommodating different attitudes and information needs. Emphasising customised strategies that take into account the work environment, motivations for participating in the study, willingness to share experiences and experience of utilising various technologies.

V. Limitations

The studies discussed in this paper are limited and focus on particular groups of end-users (who have chronic diseases) or software practitioners (who are mainly involved in RE), reflecting our recent research efforts [5]–[8]. There was significant variation among participants across different samples, and the suitability of different study types was greatly affected by the characteristics of the recruitment strategies used [46]. Other studies may have encountered different significant barriers unknown to us or utilised other recruitment strategies. The COVID-19 pandemic during the study period forced us to conduct remote studies and primarily recruit participants through online channels. As a result of this shift, we might have encountered a different set of barriers compared to studies conducted or recruited in person [60].

VI. Conclusion

Recruiting participants for research studies presents distinct challenges, depending on whether the target group consists of end-users or software practitioners. By tailoring recruitment strategies to the specific needs and characteristics of each group, researchers can enhance participant engagement, ensuring data integrity, and ultimately achieving more reliable and impactful research outcomes. Future research should continue to explore and refine these strategies, considering the evolving landscape of participant recruitment in diverse fields.

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