# Community Building with Co-located Social Media: A Field Experiment with Syrian Refugees

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## ABSTRACT

While co-located social media previously has been employed to enhance interaction in community building activities in previous work, its range of effects have not been quantitatively described. In this study, we introduce a co-located social media app called SpeakUp to a community building project in the Za'atari Syrian refugee camp in Jordan. To overcome issues such as the lack of Internet access, we purposefully adapted the design of the application and ported its server to a low cost single board computer on a Raspberry Pi. We explore the effects of SpeakUp through field experiments with one control and two treatment groups, as well as with interviews and observations. Our results show that SpeakUp significantly increases refugees' level of participation and sense of community. Importantly, with the use of the application, female and male participants demonstrate no significant differences in participation, showing that the use of such applications can be equalizing. We also found that co-located social media supports asynchronous interaction when outside-the-classroom activities are involved.

## CCS CONCEPTS

•**Human-centered computing** →*Field studies;* •**Networks** →**social media networks;**

## KEYWORDS

Co-located Social Media, Community Building, Level of Participation, Sense of Community, Field Experiment

## 1 INTRODUCTION

As documented in the Syrian refugee crisis, when the displaced are fleeing or settled into a temporary place, mobile technologies and Internet access have become crucial communication tools to maintain contact with family members and friends scattered around the world [59].

Accordingly, service providers are actively seeking opportunities to make use of these technologies in order to help refugees coping with such dire situations. For instance, Google launched an application named Crisis Info Hub in Greece to help newly refugees access critical information [16]. Research communities also respond by conducting and advocating targeted projects to alleviate the disastrous situation. For example, Talhouk et al. explored mobile phone usage in improving antenatal health for Syrian refugees in Lebanon [51]. Barnoff et al. used near field communication technology with feature phones to help newly arrived refugees gain contextual information through collecting and distributing existing knowledge of settled refugees [4].

With the refugee crises extending in duration across the globe, organizations in the host countries of refugees increasingly take on bottom-up community approaches in the development of refugees' livelihoods [1, 60]. Humanitarian service providers are seeking sustainable approaches to engage the affected population in building new lives.

However, challenges like a lack of information infrastructure and channels for information sharing persist [53]. Refugees also constantly experience low sense of belonging [19, 30]. Many refugees in the world, especially those residing in rural camps, lack reliable cellular connectivity as well as Internet access. Therefore, it is harder to meet their informational needs, with resulting effects for community building in these increasingly dire and prolonged situations.

Social media could be a powerful enabler to foster a sense of belonging and community, but it has yet to be adequately investigated. From a previous study in the Za'atari Syrian refugee camp in

Jordan, Xu et al. found that, on average, refugees used social media on a weekly or daily basis despite the relatively high cost. From this same study, it was found that WhatsApp, a social messaging tool, was used significantly more frequently than mobile voice, SMS, email and Skype [59]. In addition, social media has been found to improve interaction [27], information sharing [6], and social capital [35] in community building efforts.

Therefore, this study uses a co-located social media application to understand its role in community engagement and broader social interactions with the refugee community. While traditional social media such as Facebook require an Internet connection, co-located social media can overcome the connectivity challenge by running on a local server or an ad hoc network [28]. For refugee communities, this is important: a stable Internet connection is not always guaranteed due to lack of infrastructure, excessive cost, and policy disputes [53, 54]. Here, we argue that the scarce availability of cellular data networks makes the potential offline capabilities of co-located social media more valuable to refugees, when compared with traditional social media. We investigate the use of co-located social media in community building with a focus on two main research questions.

(1) Can co-located social media increase refugees' level of participation in community building activities in refugee camps?
(2) Can co-located social media increase refugees' sense of community in community building activities in refugee camps?

To answer these questions, we perform field experiments in the Za'atari refugee camp using SpeakUp, a co-located social media app, during the implementation of a community building project in the camp.

This paper is structured as follows. First, we present related work. Then, we discuss community building activities in our research site - Za'atari Syrian refugee camp in Jordan. Subsequently, we introduce SpeakUp, the co-located social media app we adapted for the context. Later, we propose our research methods as well as data analysis plans. After demonstrating our findings, we discuss some theoretical and practical design implications as well as limitations and future research areas accordingly. Last, we conclude our study with a vision for the future.

## 2 RELATED WORK

While there is a dearth of work focusing in particular on empowering refugees, community building and equalizing technology scholarships have created several key insights to draw from. In particular, the fields of Information and Communication Technologies for Development (ICT4D) Human-Computer Interaction for Development (HCI4D), and Digital Civics all lend different methods and ideologies to address similar questions.

For both the ICT4D and HCI4D communities, the research is rooted in a deliberate and careful use of technologies that can support development by empowering communities [22]. Digital Civics research believes that digital technologies facilitate and encourage citizens to play a greater role in community building, infrastructure

management and services delivery [18]. In doing so, it seeks to answer how citizens can be empowered through technologies to overcome their power differences with authorities [55]. Typical projects involve promoting dialogues among stakeholders [12]. As many refugee camps function like cities [43], using digital technologies to engage refugee communities in civic planning and community building is a promising area.

Going further, we will present specific work from the perspective of both co-located social media for community building as well as ICTD with refugees.

### 2.1 Co-Located Social Media in Community Building

Researchers have increasingly created and used social media to examine social change and community building [35, 39]. Co-located social media refer to applications deployed in a context where users share a physical space. The goal of such application is to blend digital and face-to-face interaction, thereby enhancing the community's total level of interaction and engagement.

Co-located social media, when compared to traditional social media, usually have an emphasis on synchronous experiences augmented by mobile or wearable devices [40, 42]. Classrooms are one of the more commonly explored settings. Introducing the use of co-located social media in classrooms, researchers have found that the level of community engagement can be significantly enhanced with the combination of virtual and face-to-face interaction, when compared to traditional classrooms or purely online courses [47].

In order to provide co-located social media support, many artifacts have been devised, from mainstream tools such as Twitter [44, 45], to more customized social media tools for co-located interaction, such as Backchan.nl [21], Pigeonhole [17], SpeakUp [27] and others [5, 13]. Findings show that co-located social media contribute to an increase in participation and are usually perceived positively by its users. However, it is a challenge to build an inclusive digital channel that increases the number of active participants, as interaction on social media is generally divided into many content consumers with only a few contributors [57]. Anonymity is a feature that can be integrated to address this by making users more comfortable in expressing views virtually that they would not share face-to-face [32].

Other than the level of participation, participants' sense of community is another widely used metric of the effects of community building activities. Sense of community as a metric usually contains four dimensions: membership, influence, fulfillment of needs, and shared emotional connections [38]. Sense of community has been found to have positive associations with empowerment and social change [34], social cohesion [58], as well as community participation and psychological empowerment [41]. Sense of community is often seen as a catalyst for civic or political participation [52]. However, it is rarely measured either in co-located social media studies or refugee studies.

Community building with camp refugees naturally relies on physical infrastructure such as classroom or classroom-like community centers [31]. The lack of available ICT infrastructure in refugee camps makes co-located social media, whereby individuals' messages are shared locally rather than on a distant server. More

importantly, the effects of co-located social media in community building can be beneficial to refugee contexts.

## 2.2 ICTD with Refugees

There is a growing group of ICTD researchers dedicating in responding to the urgent and complex refugee crisis [50]. Notwithstanding the previously mentioned connectivity challenges, the ability to make a positive impact has increased in recent years with the increasing rates of mobile phone ownership, Internet penetration, and general digital literacy in the refugee communities.

Humanitarian technologies are widely used to alleviate global refugee situations. From the perspective of the United Nations High Commissioner for Refugees (UNHCR), technologies are implemented to more effectively perform crucial duties, such as registering incoming refugees as well as providing services and protection [2, 36]. As other aid agencies use this information as well, some of the primary goals lie in improving the delivery of information and resources to diverse and dispersed communities [11, 15].

Instead of building information systems primarily serving aid agencies, ICTD researchers are seeking opportunities to work directly with refugee communities. Refugees generally carry limited resources and weak social ties with their friends and families. Approaches of sharing resources and support are extremely valuable in getting through the hardship [56]. In addition, many refugees own and share mobile phones, which extend their approaches to gain information for connection and community building [8].

The main goal of such ICTD projects is to bring refugees new experiences that can improve the quality of their lives. The efforts are relatively decentralized reflecting their diverse and unique situations. For example, Aal et al. migrated computer clubs from their experience with migrants in Germany to refugees in Palestine to foster learning, social networks and integration with local environment [1]. Using qualitative field notes and interview data, they found that refugees were eager to engage in projects, especially those involving technologies, despite the constant hurdles posed by poor or inconsistent access to the Internet and electricity.

Increasingly, studies are designed to target refugees' unique challenges and provide community-based solutions using information technologies. For example, Talhouk et al. focused on antenatal care system for Syrian refugees who are temporarily settled in Lebonon. They identified contextual factors that can inform the design of mobile technologies in supporting antenal care through focus groups [51].

In general, the current research with refugees on community building is in its exploratory phase [60]. To our knowledge, there are few studies on the effects of digital artifacts in refugee community building, especially with quantifiable measurements. Researchers either do not consider community building as a prioritized area for refugees, or are still in the phase of evaluating the capacities and potentials for information technologies.

## 3 RESEARCH CONTEXT: COMMUNITY BUILDING IN THE ZA'ATARI REFUGEE CAMP

Za'atari is a refugee camp located next to the Syrian border in Jordan. After about five years of existence, there are about 80,000

Syrian refugees in the camp along with more than 40 aid agencies. The camp is organized into 12 districts, with aid agencies housed in a separate base camp. Almost every district has its own community center set up for aid agencies and refugees to come together to learn from each other. Some centers also spared one caravan to build a computer lab with Internet access provided.

We have been working in Za'atari for more than two years on various community building and network projects. Our investigations with several aid agencies have brought to light the fact that many challenges remain. Among them are low level of participation, a lack of activities the refugees find interesting, and power differences between service providers and participants. These factors are hindering the effectiveness of community building in Za'atari.

Importantly, there is no consistent cellular network available across the camp. While refugees can access the Internet through community centers, the connections are often affected by power shortages. Despite these challenges, attempts are currently being made to foster community building activities through information technologies. These efforts include training with refugees on using asset mapping to familiarize themselves about their community, and then hopefully to mobilize the asset data into community's decision-making process.

Our investigation of a co-located social media application is conducted along with this training on community building in Za'atari. During July and August of 2016, training sessions for refugees to learn to collect, analyze and utilize asset data to address community problems were implemented. The purpose of the training sessions is to develop an asset inventory together with refugees by using Kobo Toolbox [1] and ODK Collect [2]. This training consists of three major phases: data collection, data analysis and data utilization. Data collection requires a significant amount of time for refugee participants to get out of the classroom to the households to collect asset data. Meanwhile, training refugees in conducting data analysis and data utilization takes place inside the classrooms. A combination of field and classroom activity represents a notable distinction when comparing to other settings co-located social media applications had been tested.

The idea of the current study is to tackle these issues by providing an additional digital communication channel in a community building activity through a co-located social media application. The goal of exploring SpeakUp is to investigate whether it can help engage participants in this community building activity by developing a sense of community with other participants and enhancing their level of participation.

## 4 SPEAKUP

SpeakUp[3] allows users to create chatrooms and invite others to join anonymously using the room number (see top left image in Figure 1). Inside a room, users can create new posts, comment on posts, upvote or downvote existing posts, and respond to polls (see Figure 1). SpeakUp has been evaluated in different settings and is appreciated by both instructors and students [27, 46]. It provides good to excellent usability (its System Usability Scale (SUS) [7] score

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[1] Kobo UNHCR Toolbox, http://kobo.unhcr.org
[2] Open Data Kit, http://opendatakit.org
[3] SpeakUp is freely available on: https://speakup.info

is 83) [27]. For example, SpeakUp has been observed to increase participation in university classrooms [27]. These settings were tested through the use of the Internet.
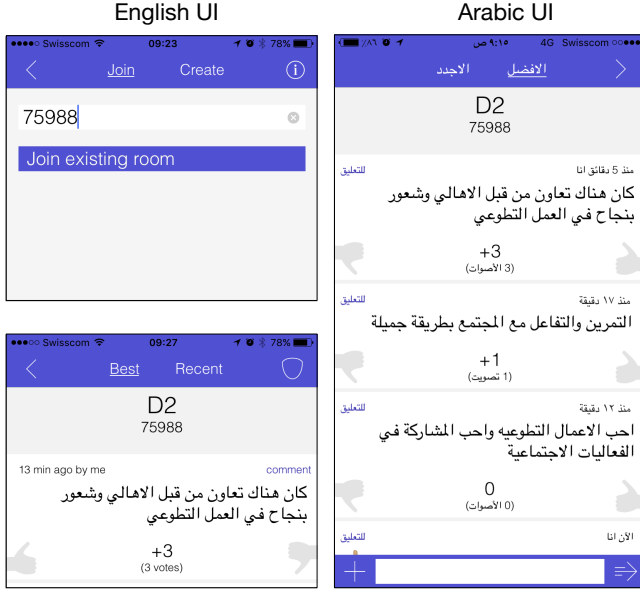


**Figure 1: Interfaces of the SpeakUp App**
(Note: texts are from one of our treatment groups.)

One feature of SpeakUp is an offline version that can run on very lightweight hardware, such as a Raspberry Pi. This feature is designed specifically to address the previously mentioned Internet and electricity challenges in the camps. We refer to this version as the SpeakUp Box. In this offline version, there is no need to connect to the Internet: users can simply connect their mobile devices to the WiFi network created by the Raspberry Pi, which is powered by a small battery pack (as shown in Figure 2). When connected to this WiFi, the mobile SpeakUp app or any browser via speakup.info will automatically connect to the local SpeakUp server.



**Figure 2: The SpeakUp Box (a SpeakUp server running on a Raspberry Pi low cost single board computer).**

In SpeakUp, there is no personally identifiable information recorded as there is no login required. However, users can still voluntarily choose to disclose their identity. Also, unlike some social media such as Twitter, messages in SpeakUp are never viewable by all of the application's users: messages are sent only to the other users who have joined the same chatroom. When using the offline version with the combination of SpeakUp and RaspberryPi, we also keep all our data local. Users can use their browsers or the SpeakUp app as if they were online, but the data is stored inside the RaspberryPi's memory card.

## 5 METHODS

In our study, we explore the roles of co-located social media in refugees' community building, especially in influencing their sense of community and level of participation. The design of our research is guided by the design science methodology [23, 49]. We break down the methodology into three main steps: problem investigation, artifact design and artifact evaluation. To investigate the problem, we first frame the research question for the particular context of the Za'atari refugee camp. As we are building on exploratory studies that have been done in the same location, identifying the problem space will not be the emphasis of this paper. Then, we illustrate the rationale behind the design of our co-located social media used in this study, SpeakUp, which is engineered to accommodate the specifics of the camp refugee situation. Later, we provide evidence on the effectiveness of the artifact through multiple field experiments in Za'atari, which we designed to have one control group (without the use of SpeakUp) and two treatment groups (with the use of SpeakUp) so that we can effectively separate the influence from SpeakUp. These two treatment groups are handled independently in administering the experiment but are otherwise identical.

### 5.1 Field Experiments

The experiments were conducted in classrooms in the community centers of District 9 (E1), District 8 (E2) and District 2 (E3) with the facilitation of a translator. Figure 3 highlights the geographical location of the community centers inside the refugee camp.

Each classroom was equipped with 15 laptops (one for the researcher and 14 for participants) and 9 Android tablets. E1 was randomly assigned as the control group, and E2 and E3 were assigned as treatment groups using SpeakUp.

In every condition, participants first received a two-day training on data collection and data analysis. They were encouraged to raise questions at any time. Afterwards, all participants were grouped into teams of two and each team spends two days collecting asset data from a total number of 120 households. During data collection, we also scheduled discussions every day for participants returning from the field to discuss their experiences. This is designed to control for the quality of the data collection as well as to enhance interactions among participants. For the last day, participants learned how to access the data they collected and how to conduct simple data analysis to obtain the information they were interested in.

For treatment groups E2 and E3, we additionally introduced SpeakUp as a supplementary communication channel at the start of the training. More precisely, SpeakUp was used in the following
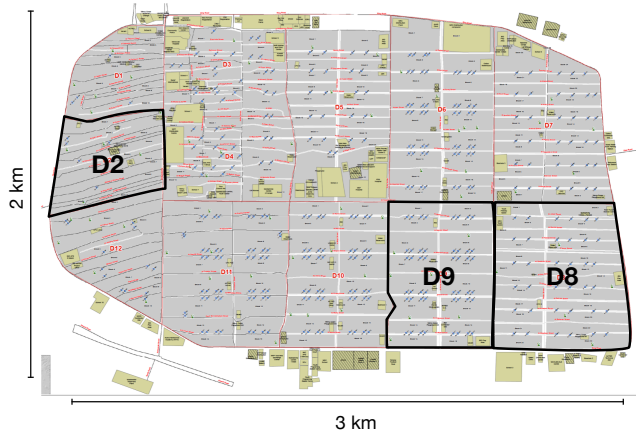
**Figure 3: Map of the Za'atari camp showing the districts (D2, D9, D8) where the evaluations took place.**

two ways. First, participants were able to use SpeakUp to ask questions throughout the whole week of activities. Additionally, the trainer can initiate the interaction by asking questions related to the materials or asking the participants to share their field experiences.

With this setup, it allows us to test the following proposed hypotheses:

> **H1:** *Co-located social media usage will increase the level of classroom participation.*
> **H2:** *Co-located social media usage will increase the sense of community.*

We use a mixed method approach in order to obtain quantitative and qualitative data to test this hypotheses [10]. To measure the participants' behaviors, we analyze the logs of their SpeakUp usage and recorded observations from notes and pictures. To measure our participants' attitudes, we administered surveys at the end of each condition and perform six one-to-one semi-structured interviews on participants' SpeakUp experiences.

### 5.2 Surveys

We issued a pen-and-paper survey after the week-long community building activity. The main survey constructs include the sense of community, level of participation and usability of SpeakUp.

Measuring the sense of community can be difficult; since the types of community building projects vary significantly, there is heated debate over whether there should be a single, universal indicator or multiple different ones depending on the context [24]. For the purpose of our study, we used an established construct designed for the classroom context: the Classroom and School Community Inventory [48], as our focus is on building the sense of classroom community in learning environments and the activity is mainly conducted in a classroom-like setting. The Classroom and School Community Inventory covers two main aspects of a classroom community: connectedness and learning.

To measure the level of participation, we designed our own metrics based on the nature of the community building activity as well as the context in Za'atari refugee camp. It includes six items

covering everything from participation in the class to interaction with fellow participants in the classroom context.

To measure usability, we employed the widely validated System Usability Scale Questionnaire [7]. All the detailed items of our four main measurements can be found in the Appendix.

For all three constructs, respondents were asked to answer on a five point Likert scale (0 = I strongly disagree, 4 = I strongly agree).

As we are interested in measuring the differences between the control and treatment groups in their respective sense of community and level of participation, we used t-tests to compare the two groups' survey responses.

### 5.3 Interviews

In addition to the quantitative survey instrument, we also conducted semi-structured interviews with three females and three males in order to understand their experiences with the use of SpeakUp. The interview questions covered refugees' perception on the usefulness of SpeakUp and their suggestions for future development. All the interviewees finished the entire whole-week activity. We randomly selected two participants from each of the three conditions. Their ages range from 19 to 38 years old. Each interview lasted for about an hour.

Analyzing this qualitative data, we aim to get detailed feedback on participants' experience using SpeakUp as well as to get inspirations for future development. We use quotes to represent our participants' voices discussing these aspects of the application.

### 5.4 Digital Interaction Data

Other major data sources from the study are the meta-data and post content from the logs.

The meta-data covers the number of posts, comments, upvotes and downvotes. We mainly use this data for descriptive analysis to gain an overview of the way our participants used SpeakUp.

We additionally coded the content of each post for references to the interaction of community building activities. We use the coding scheme developed by McCarthy et al. [37]: work, logistics, and other. We had two coders who classified the posts independently and later discussed to solve conflicts. Both expected and unexpected categories emerged: we needed to add a fourth category of message related to class feedback.

## 6 RESULTS

In this section, we are going to present the details the demographics of the participants and findings drawn from multiple sources of data.

### 6.1 Participants

Our participants were recruited with help from UNHCR and local aid agencies. Our original goal was to recruit 14 participants (7 females and 7 males) with basic digital literacy for each condition, so that every participant can have access to a laptop. However, each condition ended up with a different number of participants; moreover, genders within each condition were imbalanced (see Table 1). Given the time constraints, we were not able to ensure our ideal participant distribution. For conditions E1 and E2, some volunteers were unavailable for the whole week, thus they had

to drop out. For the last condition E3, too many volunteers were recruited. Figure 4 shows the training activity in the classroom of E3.



**Figure 4: A training session in the classroom of District 2 (E3).**

Even though this is an important issue when controlling for the conditions, variations in the age range and number of participants are inevitable features of field experiments [20]. Moreover, using truly random sampling to select our participants was not realistic, as there is no publicly available information on the total number of refugees who meet the recruitment requirements. Therefore, we relied on aid agencies' indigenous knowledge about the community to identify participants who were likely to engage in community building activities as well as who possessed basic digital literacy.

**Table 1: Overview of the Participants**

| ID | District | Participants (F) | Age (Mean) | SpeakUp |
|----|----------|------------------|------------|---------|
| E1 | D9 | 14 (0) | 17-33 (24) | no |
| E2 | D8 | 11(3) | 18-30 (25) | yes |
| E3 | D2 | 22 (14) | 17-65 (34) | yes |

Note: E1 is the control group.

## 6.2 Interaction Analysis

In general, in terms of usability, SpeakUp is rated as *good*, with a SUS score of 72 [3]. Next we are going to present the findings from the metadata and content data from the treatment groups' SpeakUp logs.

*6.2.1 SpeakUp Metadata.* Table 2 shows the overview usage of SpeakUp in two treatment groups covering the number of viewers, contributors, and their total number of posts and votes. Note that the numbers of viewers and contributors are based on device IDs, which means that if two participants shared a device, they are only counted as one. This also applies when participants use more than one device, which is why Table 2 shows there are more viewers and contributors combined than the number of participants. This is because many participants used their own personal mobile phones in addition to the tablets provided.

The results convey the fact that the level of interaction with SpeakUp is modest (only 2-3 posts per participants), but this is comparable to other classroom settings with SpeakUp [27]. Nevertheless, the majority of the active devices in both groups contributed actively by at least posting one message (as shown in Figure 5). The highest number of comments one post got is 4. Our participants votes were almost entirely positive, with only a single case of a negative vote (about 1%). However, in other classroom settings the rate of negative votes is relatively high (with an average of 39%). In E3, the posts in total received 74 upvotes (with an extra of 19 upvotes got cancelled) and 2 downvote (with an extra of 1 downvotes got cancelled). This shows that our participants spent some time using the voting feature of SpeakUp.

**Table 2: SpeakUp Usage Overview**

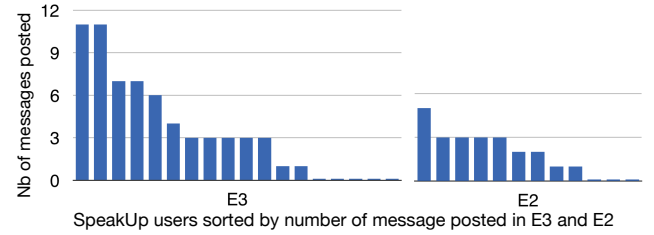| ID | Viewers | Contributors | Posts | Votes |
|----|---------|--------------|-------|-------|
| E2 | 12 | 9 | 23 | 3 |
| E3 | 17 | 13 | 63 | 76 |



**Figure 5: Distribution of SpeakUp Usage**

We also find that E3, which had twice as many participants as E2, had more interactions over SpeakUp. We can infer that participants in a small class have much more chances to interact with the instructor directly, thus they are less likely to use digital form of interaction.

*6.2.2 SpeakUp Post Content.* The posts are mainly from two types of interactions. The first type of posts are spontaneous: participants ask whatever questions come to mind throughout the course of the community building activity. The second type are initiated by more specific interactions, such as when the instructor asks questions related to the training or prompts the participants to share their personal experiences after collecting data in the field.

Overall, we classify all the messages into four categories:

(1) messages related to the course *Content* (53%), mainly describing the resources/assets in the camp, e.g., "Hospitals", "We found a low degree of education";

(2) messages related to the *Experience of data collection* (28%), e.g."People were greatly interested and responsive to us, especially the unemployed";

(3) messages giving *Feedback* of the course (11%), e.g., "It was a pleasant and helpful course. Thank you.";

(4) messages that are *Non-relevant* (8%), e.g., greetings like "Hello".

Among all the 86 posts, 29 of them (34%) received a positive score (i.e., the number of upvotes was higher than the number of

downvotes), with 11 posts belonging to Content, 14 relating to Experience and 4 being Feedback. Non-relevant messages were not upvoted.

We also find that most Experience messages (58%) got upvoted. In addition, 11 posts were upvoted by their creators. It should be noted that both positive and negative Experience messages were upvoted, this is in line with the interpretation of an upvote as an agreement of the statement found in other settings [26]. There was only one message that received a downvote (along with 2 upvotes): "We did not know about the presence of high-level certificates." The downvote could be interpreted as a disagreement.

## 6.3 Hypotheses Testing

Among 47 participants, we received 41 usable surveys: 14 from our control group and 27 from the treatment group (E2 and E3). The internal reliabilities of our measures are acceptable for system usability, sense of community and level of participation (i.e., Cronbach's $\alpha$ was 0.81, 0.82, and 0.66 respectively).

To analyze the role of the SpeakUp app, we measure the differences between the control group and the treatment group by using t tests. As there are no significant differences between E2 and E3 on participation (t = .67, df = 7, p = .52) and sense of community (t = .36, df = 14, p = .72), we combine their data into a single treatment group for hypothesis testing.

Table 3 presents the mean and standard deviation of the measures for both control and treatment group. T tests are used to test the differences in the level of participation and sense of classroom community between the control and treatment groups. Table 4 shows the hypotheses, t test results, and significance values. From the p-values of t tests, we can tell that both H1 and H2 are supported, suggesting that the co-located social media tool does help to promote the level of participation and sense of community in our community building activity in Za'atari.

**Table 3: Descriptive Statistics of Level of Participation and Sense of Community between Control and Treatment Groups**

| Groups | Level of Participation | Sense of Community |
|---|---|---|
| Control Group | mean = 2.79, sd = .31 | mean = 2.45, sd = .54 |
| Treatment Group | mean = 3.12, sd = .35 | mean = 2.82, sd = .53 |

**Table 4: Hypotheses and Results**

| # | Hypothesis and t test result | t stat | Sig |
|---|---|---|---|
| H1 | SpeakUp ↗ Level of Participation supported | t = 3.08 (df = 30) | p = 0.004** |
| H2 | SpeakUp ↗ Sense of Community supported | t = 2.07 (df = 26) | p = 0.049* |

Note: * p <0.05, ** p <0.01

Since there were no females in the control group, we can only investigate gender differences in the treatment group to see if these could have contributed to the results.

Within the treatment groups, there are 17 females and 16 males. Table 5 shows the descriptive statistics of gender scores for level of participation and sense of community. However, a t test failed to show significant differences between female and male groups, neither in the level of participation (t = 0.10, df = 15, p = .92) nor in the sense of community (t = 1.01, df = 11, p =.33).

**Table 5: Descriptive Statistics of Level of Participation and Sense of Community within Treatment Groups**

| Groups | Level of Participation | Sense of Community |
|---|---|---|
| Females | mean = 3.11, sd = .34 | mean = 2.91, sd = .39 |
| Males | mean = 3.13, sd = .39 | mean = 2.66, sd = .70 |

## 7 DISCUSSION

We have shown the positive role SpeakUp has played in the level of participation and sense of community, next we are going to discuss the results further with the support from our interview data and put them in perspectives with broader research and design implications. We also summarize the limitations, which help us envision future studies.

## 7.1 Co-located Social Media Offers an Additional Channel for Refugees to Participate

As we have mentioned earlier about the general scarcity of information infrastructure in refugee communities, and the Za'atari camp refugees face specific challenges. The use of SpeakUp with Raspberry Pi provides an additional communication channel especially when there is no stable Internet guaranteed.

In particular, many participants expressed their appreciation of the anonymity feature. This is especially true for young people when there were respectful seniors in the same classroom, as well as for some females who wished to be anonymous when males were present. Anonymity could be regarded as an enhancing factor that influences participation by allowing people to overcome shyness [32] and power differences within refugee community as well as with aid agencies [33]. Furthermore, anonymity is also seen as an intriguing feature, and participants disclosed their intention to guess who posted certain messages. A study [9], comparing anonymous (e.g. Whisper[4]) to non-anonymous (e.g. Twitter [5]) social media, found that anonymity also implies more personal information, more negative emotions (anger and sadness) and more messages about wants and needs, in addition to increased interaction [32]. However, from our experiments, we adopt similar usage strategies to western classrooms and find many similarities in the attitudes of participants towards the app, e.g. excitement and increased participation. Among the notable differences, refugee participants made almost no use of the downvote. This can partially be explained by the fact that there are few Non-relevant messages posted during the whole training (in other settings downvotes are used to make these messages less visible, e.g., [26, 27]). It could also be explained by

[4]Whisper, https://whisper.sh/
[5]Twitter, https://twitter.com

the fact that the small class could imply closer social relationships that could mitigate both Non-relevant messages and negative votes.

From another perspective, our study extends the findings of co-located social media on participation to a particular context, where Muslims of mixed genders and ages are rarely co-located in the same classroom [25]. When in a mixed setting, women and younger people are more likely to be in a disadvantaged position in terms of having their voices heard. Interestingly, we find no significant differences between females and males in the level of participation and sense of community when using SpeakUp.We argue that SpeakUp not only offers an additional communication channel, but also helps disadvantaged sub-communities participate.

Additionally, SpeakUp provides a supplementary communication channel for the participants when the instructor was busy, As one male participant noted (M1): "*when the instructor is busy solving problems with other students, I can still ask questions on SpeakUp and get answers from the rest of the class.*"

Finally, the social rating feature was appreciated, and some participants said they were monitoring the status of their own posts. One young female participant (F1) related: "*it is always delighted to see my post voted up.*". This social aspect suggests that participation is not only restricted to instructor-students interaction, but also it allows for student-student interaction, which could build a stronger sense of community among students.

## 7.2 Co-located Social Media Enhances the Sense of Community

This study for the first time explored the use of co-located social media in promoting participants' sense of community, particularly in the context of community building in refugee camps. And we find positive association between them.

For the existing studies on co-located social media for community building, the main goal is to promote community members' participation in synchronous interactions such as expressing ideas, giving feedback and subsequently adjusting actions. Even though within the refugee studies there are projects aiming at building a more connected and effective community, e.g. computer lab project for Palestinian refugees by Aal et al.[1] and antenatal health for Syrian refugees by Talhouk et al. [51], few studies have used quantitative methods to systematically measure the effects of the projects in influencing the sense of community among the participants. This is important because sense of community is closely associated with building sustainable and resilient communities.

Our participants enjoyed spending time reading and commenting on other people's posts, as well posting their own experiences. One male participant (M2) said "*I enjoy reading other people's post. I get inspired from them to express my own.*" Participants related to the sense of community triggered by shared messages. For example, F2 mentioned: "*I know I am not alone in facing those challenges when doing caravan household data collection.*" Some participants also used SpeakUp for communicating informally with the group. When looking at the log data, the post which received the highest number of comments said: "*We like volunteer work because we love interacting with the community.*" The posts that get the best score represented the experiences that resonated the most with each other.

## 7.3 Co-located Social Media For Asynchronous Interaction

During our investigation in community building activities, we found that participants liked to use SpeakUp to share information asynchronously. The initial interaction is promoted by the instructor to get to know the classroom participants' experiences in gathering the households' asset data as well as to address any data collection related challenges. As the project involved a significant amount of time interacting with refugee communities outside of the classroom, every participant's experience might differ, including the duration of the field activities for each participant. The disruption this field work brought to the classroom activity opened an opportunity for SpeakUp to bridge. Participants like F2 mentioned in the last paragraph enjoy reading the posts posted while they were not present in the classroom. Another male interviewee M3 also added: "*I feel like I experience five times more than I did.*" Reading and posting information about their experiences on SpeakUp after field activities required only three days to become a routine for the participants. Beyond our planned scenarios for SpeakUp, it served as a de facto archive of experiences. This shares similar features with a forum or blog, which are found to contribute to the sense of community [14]. Therefore, we argue that SpeakUp enhances asynchronous interactions when the community building activity includes field work outside of the classroom. Future work could further inform on the boundaries between interactions with short lived messages for a co-located crowd and eternal blog posts for the public in the context of community building.

## 7.4 Design Implications

In this study, we migrated a co-located social media app from classrooms in the West to classrooms of refugees in the Middle East. Taking experience from the West and adapting it to development contexts should not be implemented without taking some precautions [1, 29]. Our study can provide practical insights for other researchers, system designers, and local stakeholders addressing similar challenges.

*7.4.1 Design for Limited Technology Resources.* When conducting field research in rural areas using information technologies, there is no guarantee of stable Internet, power, and other resources that can be taken for granted. Using a local server to avoid dependency on the Internet connection and using browsers to access the application were helpful in successfully conducting our experiments. Even downloading an application is not trivial because of connectivity issues and space limitations on the phones. Also, using email to sign up is not widely feasible, first and foremost is that most of the people do not use email in their daily communication at all. Our study avoided this problem by allowing users to access the application without signing up. If signing up is required, we would recommend using mobile phone numbers which is a widely used practice of tools like WhatsApp. In addition, electricity can be very unstable thus alternative plans on charging all the devices should be considered.

*7.4.2 Design for Multimedia Expectations.* Even with limited resources, people still have high expectations on the available features in order to maximally share their experiences. One participant (F3)

said "*I wish I can post pictures or audio in SpeakUp to share my experience with others.*" Especially with field activities or even flipped classroom strategy involved, participants would be eager to share their unique experiences.

*7.4.3 Design for Multilingual Field Research.* As we had to rely on translators for communicating with the participants, an embedded translation tool for all the posts would be a useful feature to enhance the interaction among people who speak different languages. Even though we have interfaces currently supporting languages including English, Arabic, French, Spanish, and Chinese, further development on real time translation is needed, which is difficult while managing constraints like an unstable Internet connection, which requires the application to be lightweight enough to run on a Raspberry Pi.

## 7.5 Limitations

Our study has a number of shortcomings that limit the generalizability of our findings, even though some of the shortcomings are inherent to the challenging setting in which the study is conducted. Here we list two main limitations: First, the study was implemented along with a single community building project. Therefore, we had a relatively low number of participants. In addition, our experiment conditions were not strictly manipulated, which resulted in different number of participants with different demographics in each condition. This affected our further understandings of the differences and similarities between female and male participants' roles in community building. Second, while we used a control group, we did not do a survey before the experimental intervention. Thus, we could not measure the baseline for each condition, which means that differences in the outcome could be due to differences between the groups. This makes it is harder to account for effects according to demographics or other features. An additional pre-manipulation evaluation could also help us ensure the accuracy of the statistical analyses.

## 7.6 Future Research

Future research should first address the limitations from this research.

First, we will strictly follow the experiment design criteria even when it is hard to turn down the refugees' enthusiasm in community building projects. The benefits will be two-fold: first we can effectively measure the gender differences in responding to the co-located social media; and second, with pre-post evaluation measured we can get better baseline knowledge of our participants.

Second, we will further explore the potentials to upgrade SpeakUp to account for the suggestions we discussed in design implication section.

Third, as one of the important goals of community building program is to be inclusive to all the community members, we should extend the research focus from the classrooms to the whole camp site and investigate different roles co-located social media might play. For instance, we will explore whether SpeakUp can be adopted in community gatherings and other types of community building events where power differences can be bigger between affected community and aid agencies. This can further shed the light on a more general role of co-located social media in community building.

In those situations anonymity can also become a welcome feature to help community members to express themselves openly and to help aid agencies receive honest feedback to improve their service provision.

## 8 CONCLUSION

In this paper, we conducted a field experiment of a community building project in the Za'atari Syrian refugee camp. We investigated if introducing a co-located social media application, SpeakUp, could promote community building experiences. The tool was adapted for the local humanitarian context (language, local server, and distribution of devices). Our findings show that using SpeakUp during the training significantly increased the level of participation and the sense of community compared to the control group. We find that using SpeakUp is particularly useful in mixed gender and age groups, since people with disadvantaged social status, such as women and young people, are able to use SpeakUp to engage in interactions, which they would not have done face-to-face. We argue that co-located social media can be embedded in existing or future community building activities to increase the level of participation and sense of community by exchanging knowledge and increasing social interactions, especially for the voices unheard. Adding such an anonymous communication channel could potentially overcome power relation. In the future, we plan to use SpeakUp to investigate community building in other contexts by investigating the different situation of urban refugees or by involving aid agencies in the activities. In particular, we would like to discover if our findings of the gender gap on voting and posting behaviors holds across a variety of situations. We hope our findings can be helpful for both practitioners and researchers in the areas of ICT4D and HCI4D in promoting sustainable development for marginalized communities.

## A USABILITY

  (1) I think that I would like to use SpeakUp frequently.
  (2) I found SpeakUp unnecessarily complex.
  (3) I thought SpeakUp was easy to use.
  (4) I think that I would need the support of a technical person to be able to use SpeakUp.
  (5) I found the various functions in SpeakUp were well integrated.
  (6) I thought there was too much inconsistency in SpeakUp.
  (7) I would imagine that most people would learn to use SpeakUp very quickly.
  (8) I found SpeakUp very cumbersome to use.
  (9) I felt very confident using SpeakUp.
 (10) I needed to learn a lot of things before I could get going with SpeakUp.

## B SENSE OF COMMUNITY

  (1) I feel that students in this course care about each other
  (2) I feel that I receive timely feedback in this course
  (3) I feel connected to others in this course
  (4) I feel that this course results in only modest learning
  (5) I trust others in this course
  (6) I feel that I am given ample opportunities to learn in this course

(7) I feel that I can rely on others in this course
(8) I feel that my educational needs are not being met in this course
(9) I feel confident that others in this course will support me
(10) I feel that this course does not promote a desire to learn

## C PARTICIPATION

(1) I often asked questions in the Asset Mapping Class.
(2) I often give my opinion.
(3) I often want to say something but I don't.
(4) I often have an opinion in class but I don't express it.
(5) I don't have problems following the class.
(6) I help others solving problems.

## ACKNOWLEDGMENTS

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