

# PARTICIPANT ENGAGEMENT IN COMMUNITY CROWDSOURCING

*Research in Progress*

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## Abstract

*Crowdsourcing refers to the use of technologies to gather the collective effort and wisdom from an undefined group of online users for organizational innovation and/or problem solving. A critical challenge for crowdsourcing users and providers is to engage online participants to make sustained contributions. This research in progress paper proposes a behavioural perspective on the definition and measurement of participant engagement in community crowdsourcing, a crowdsourcing model where all participants can see and react to everyone else ideas. In our research, we propose to conceive participant engagement as a set of engaging behaviours and evaluate it through the magnitude, temporal intensity, diversity, and recency of these behaviours. We illustrate the construct operationalization by the Participant Engagement Index (PEI) that quantifies engaging behaviours in the context of Mind-Mixer, a community crowdsourcing service provider. We further provide an initial illustration of the PEI's utility through the analysis of field project data from MindMixer. We expect that our study will provide guidance for future research into existing and new practices to study and improve the active and sustained participation of crowds in open collaboration forums.*

*Keywords: Community crowdsourcing, social media, engagement.*

## 1 Introduction

Crowdsourcing refers to the use of technologies to gather the collective effort and wisdom from an undefined group of online users for organizational innovation and/or problem solving (Howe, 2006). The idea of crowdsourcing has been quickly embraced and employed in practice (Massolution, 2012) and in various disciplines or sectors such as medicine (Norman et al. 2011), journalism (Fitt, 2011), art (Casal, 2011), finance (Belleflamme et al., 2010), and government (Bommert, 2010).

Crowdsourcing initiatives can exist in multiple forms, among which we particularly focus on community crowdsourcing in this paper. Community crowdsourcing is a form of crowdsourcing in which online participants collaborate to produce the final outcome (Boudreau and Lakhani, 2009). This is different from crowdsourcing initiatives that function as online labour market place (e.g. freelancer.com) or innovation contests (e.g. innocentine.com). Community crowdsourcing typically requires a large number of participants engaging in a discussion to make suggestions or propose solutions regarding an issue that they have a stake in. It has been used to involve citizens in debates regarding the development of their neighbourhood and cities or employees to discuss product and process innovations. Regardless of the type of crowdsourcing, a key challenge to crowdsourcing implementation is to convince online users to participate and gradually make them more engaged in the crowdsourcing tasks

(Bonabeau, 2009; Brabham, 2008; Zheng et al., 2011). While the issue is naturally important, actually addressing it is tricky, due to the ambiguity of what is meant by being “more engaged”. A participant may contribute fifty contributions the first time (s)he accesses the crowdsourcing event and never come back, or contribute less but follow every development of the event till its end. Which case should we consider “more engaged”? Another example: how should we judge the relative engagement between the participants who express high interest in the crowdsourcing tasks orally and make only one or two contributions, versus those who report moderate or even low interest, yet contribute a lot?

To address this problem, we need a clear definition of the “participant engagement” construct and a way to measure it. Achieving this goal has several benefits. First, it provides researchers with a dependent variable for crowdsourcing studies that focus on interventions and factors that drive participation. Second, it provides crowdsourcing providers a way to assess the relative performance of their crowdsourcing initiatives. Third, it benefits organizations that employ crowdsourcing to support their decision making processes; the level of participant engagement may inform the governance of the crowdsourcing effort as it provides insights regarding the quality, comprehensiveness, and persistence of the participants’ involvement.

Unfortunately, despite a considerable number of studies on motivations to participate and contribute to crowdsourcing events (Borst, 2010; Brabham, 2010, 2012; Hristova et al., 2012; Kaufman et al., 2011; Lakhani and Wolf, 2005; Leimeister et al., 2009; Morgan and Wang, 2010; Wagner and Prasarnphanich, 2007; Zheng et al., 2011), the concept of engagement itself and how to evaluate it have not been explicitly and thoroughly investigated. Most research refers to it in general terms such as “participation” or “contribution” without a clear definition. Some of them, such as those by Borst (2010) or Hristova et al. (2012) equated it to the number of submissions, yet without explicit rationale on why it was the case.

To fill this gap in the crowdsourcing literature, this research in progress paper proposes a definition and measurement of participant engagement for community crowdsourcing. Towards this goal, the paper is structured as follows. First, we review how engagement has been defined and studied in different disciplines. Second, we develop a definition of participant engagement in the community crowdsourcing context. Third, we propose the Participant Engagement Index (PEI) as an operational instance of the construct in the context of MindMixer, a community crowdsourcing service provider. We further illustrate the PEI’s utility through the analysis of field project data from MindMixer. We conclude the paper with a summary of the key contributions of this study.

## **2 Background**

To define participant engagement for community crowdsourcing, we first examined how the term “engagement” had been defined in the literature in various disciplines. This section presents our findings from the literature in information systems, organizational behaviour, education, and marketing.

As crowdsourcing is an Internet phenomenon, we searched for the engagement definition in its broader field – information systems (IS). In the IS discipline, user engagement with technology has been considered an important issue, especially in the areas of e-commerce, gaming, and e-learning (Attfield et al., 2011). Notable works on user engagement conceptualization include those by Attfield et al. (2011) and O’Brien and Tom (2008). Both of the two research groups proposed that user engagement was a synthesis of multiple psychological and behavioural states. In particular, Attfield et al. (2011) defined user engagement as “the emotional, cognitive and behavioural connection that exists, at any point in time and possibly over time, between a user and a resource”. Similarly, O’Brien and Tom (2008) proposed that user engagement was a set of attributes including “challenge, positive affect, endurance, aesthetic and sensory appeal, attention, feedback, variety/novelty, interactivity, and perceived user control”. Employing this user engagement concept, Goh et al. (2012) assessed user engagement as a composite construct of leisure, control and immersion upon their study on user engagement in mobile human computation games. However, in the context of online activities, user en-

agement appeared to be evaluated mainly through user behaviours. For example, Lehmann et al. (2012) proposed different models of user engagement with web applications based on online behavioural metrics such as number of unique users, page views, length of visits and return rates. Similarly, Colbert and Boodoo (2011) considered a website was more engaging than another one if users stayed longer and visited them more frequently than the other. In the e-learning context, Huang et al. (2012) referred to “online participation” as the level of students’ online involvement, which was quantified through the number of discussion board posts, file views, online session duration, and number of pages read. Studying active participation in online communities, Ludford et al. (2004) differentiated level of participation by the numbers of posts that participants made on the forums.

In organizational behaviour research, work engagement (a.k.a. employee or job engagement) gained much attention from both researchers and practitioners (Harter et al., 2002; Macey and Schneider, 2008a). Arguably, the most popular definition of work engagement came from Schaufeli et al. (2002), defining it as “a positive, fulfilling, work-related state of mind that is characterized by vigour, dedication, and absorption”. In contrast, according to Macey and Schneider’s (2008b), the term was understood in a broader sense, either as a trait, or a state, or a behaviour. As a trait, work engagement was considered a permanent attribute of individuals who were emotionally positive, proactive, conscientious, and autotelic. As a state, strong work engagement was characterized by a high level of positive affectivity, job satisfaction, involvement, commitment and empowerment. Finally, work engagement could also be observed from the workers’ proactive and innovative behaviours that generally went “beyond what is, within specific frames of reference, typically expected or required” (Macey and Schneider, 2008b).

In the education context, student engagement was considered an antidote to increasing dropout rates and declining student motivation for learning (Appleton et al., 2008; Fredricks and Eccles, 2002; Pope, 2002). Hu and Kuh (2002) defined student engagement from a behavioural perspective as “the quality of effort students themselves devote to educationally purposeful activities that contribute directly to desired outcomes”. Adopting this standpoint, the National Survey of Student Engagement was developed to evaluate the students’ level of involvement in school activities (Kuh, 2001). Nevertheless, other education researchers argued that the student engagement construct was not complete without including cognitive and affective elements (Appleton et al., 2008; Baumeister and Leary, 1995; Klem and Connell, 2004). For example, Appleton et al. (2006) conceptualized student engagement as a multidimensional construct with four components: academic, behavioural, cognitive, and psychological. While endorsing the multidimensional nature of student engagement, Fredricks et al. (2004) questioned the novelty of the construct. They noted a resemblance with other more established constructs such as attitudes (Epstein and McPartland, 1976; Yamamoto et al., 1969), values (Eccles et al., 1983), motivation to learn (Brophy, 1987), learning goals (Ames, 1992; Dweck and Leggett, 1988), and intrinsic motivation (Harter, 1981).

Finally, in the marketing discipline, the term “customer engagement” (CE) has gained increasing popularity in the last decade (Brodie et al., 2011). Similar to other domains, there were different understandings of the term. In particular, Van Doorn et al. (2010) introduced customer engagement behaviours (CEB) by defining it as “a customer’s behavioural manifestations that have a brand or firm focus, beyond purchase, resulting from motivational drivers”. However, Mollen and Wilson (2010) suggested that, rather than being a behavioural manifestation, CE was close to “a cognitive and affective commitment to an active relationship with the brand”.

### **3 Defining participant engagement in community crowdsourcing**

The findings from these literatures show that engagement is a relatively new but important construct both from an academic and practice perspective. A high level of engagement is desirable for or equated with positive effects on key outcomes in the respective domains (Appleton et al., 2008; Brodie et al., 2011; Harter et al., 2002; Lamas et al., 2011). However, conceptually speaking, engagement ap-

pears to be an umbrella of multiple separate constructs rather than a phenomenon on its own. Shared across disciplines is the agreement that engagement has been considered a set of positive behavioural, emotional, or cognitive attributes. As a result, there have been two general suggestions regarding the conceptualization of engagement. First, it should be evaluated as a multidimensional construct (e.g. Appleton et al., 2006). That is, the measure of the construct should be a simultaneous evaluation of different dimensions that constitute engagement. Second, engagement should be defined and evaluated through one of its representative perspectives depending on the context of study (Macey and Schneider, 2008b). We follow the second direction and approach engagement from the behavioural perspective because of three reasons. First, as crowdsourcing events are set to utilize online labour resources, it is essential that participants make tangible contributions to these events. If the participants report being highly engaged emotionally and cognitively, but do not convert this psychological engagement into actions, it will be of less interest to the crowdsourcing organizers. Second, besides being the most important engagement aspect, behavioural engagement is also the easiest to observe, especially in the crowdsourcing context. Characterized by the geographically distributed environment, it is more convenient for the crowdsourcing organizers to evaluate participant engagement through their actions than through other means (e.g. self-report). Third, as crowdsourcing is Internet-based, participants' online activities are fully recorded and can be analysed automatically. This condition allows crowdsourcing organizers to monitor behavioural engagement on daily basis and take action to boost their participant engagement in a timely manner.

To define behavioural engagement, two key challenges must be addressed. First, we need to know which behaviours represent engagement and which do not. Second, we need to know how to measure it. Thus, we examine how the issues have been addressed in a number of previous behavioural engagement definitions presented in the table 1.

Definition	Reference
<i>Customer engagement</i> - A customer's behavioural manifestations that have a brand or firm focus, beyond purchase, resulting from motivational drivers	Van Doorn et al., 2010
<i>Work engagement</i> - Work engagement behaviours are those that go "beyond what is, within specific frames of reference, typically expected or required"	Macey and Schneider, 2008b
<i>Student engagement</i> - The quality of effort students themselves devote to educationally purposeful activities that contribute directly to desired outcomes	Hu and Kuh, 2002
<i>IT user engagement</i> - the number of user actions	Colbert and Boodoo, 2011; Sunder et al., 2011

Table 1. Behavioural Engagement Definitions

Based on the above two challenges, the engagement definition by Colbert and Boodoo (2011) and Sundar et al. (2011) is too broad. Macey and Schneider's (2008b) definition is challenging to operationalize because expectation is not a fixed benchmark (Griffin et al., 2008). Van Doorn et al.'s (2010) definition has the same problem because it is difficult to know whether a behaviour is "resulting from motivational drivers". Arguably, Hu and Kuh's (2002) definition of student engagement is the clearest on the criteria of what represent engagement behaviours. However, the definition is not very directive to measurement of the construct, as the term "quality of effort" is subject to different interpretations.

In our research, we define participant engagement in the community crowdsourcing context as "*the magnitude, temporal intensity, diversity, and recency of tangible effort online users voluntarily devote to what is requested in a community crowdsourcing initiative*". We argue that this definition characterizes engaging behaviours and is instructive to the measurement of the construct. By this definition, engagement possesses some key attributes. First, it represents an effort, not a work outcome. It does not matter whether users' contributions are outstanding or mediocre; the emphasis is on the fact that they actually make an attempt to make a meaningful contribution. Second, it should be observable in some ways. The definition leaves out cases where participants express high interest in the community

crowdsourcing event but do not make any tangible contributions to it. Third, engagement is voluntary. Participants should do the things they do out of their own will, not because they are forced. Finally, participant engagement is ‘on-task’. Not everything a participant does represents participant engagement. Actions that are irrelevant to the task at hand are not considered as engagement. For example, when the task requests participants to envision the future of public transport in a city, user comments on how good their neighbours are should be considered off-task and not indicators of engagement.

Besides specifying the attributes that distinguish engaging behaviours from those that are not, we also specify how to determine which participants are more engaged than others. In particular, we propose to differentiate the quality of the engaging behaviours of different participants along four attributes - magnitude, temporal intensity, diversity, and recency.

**Magnitude** refers to the total amount of effort a single participant contributes to a community crowdsourcing event. Each contribution a participant makes requires a certain amount of effort from his/her end. Therefore, it is reasonable that the more contributions a participant makes, the more voluntary effort he/she puts into the event. The evaluation of participant engagement through the total amount of effort is in line with how the behavioural engagement has been judged in previous crowdsourcing motivation research (e.g. Borst, 2010, Zheng et al., 2011), as well as studies on engagement in online activities such as e-learning (Huang et al., 2012) and online communities (Ludford et al., 2004).

**Temporal intensity** refers to the sustained nature of a participant’s contributions over time. Our appreciation of the temporal intensity comes from two reasons. First, a community crowdsourcing initiative typically lasts for some months and involves multiple stages. Therefore, it is desirable that participants follow up during the course of the event, such as responding to the other participants’ comments and feedback on their previously submitted ideas. In fact, research on open source software (OSS) projects, which bear similarities to community crowdsourcing, showed that 80% of the OSS projects failed because the participants did not follow up (Fang and Neufeld, 2009). Second, marketing research shows that keeping existing customers is cheaper than acquiring new ones, increases the chance of up-selling and cross-selling, and enhances a firm’s popularity through word-of-mouth channel (Reich held et al., 2000). We expect that sustained engagement will bring about similar effects, such as increasing the likelihood that the participants will participate in other similar events, or be more willing to introduce the events to their friends.

In addition, when a community crowdsourcing event offers more than one way for participants to contribute, the **diversity** of participants’ effort also needs to be taken into account. That is, participants that try various activities of the event are judged as more engaged than those that are less diverse in their contributions. The activity diversity is important because it differentiates participants who enjoy only some aspects of the crowdsourcing event with those who enjoy the whole event. For example, participants who only contribute ideas are considered not as engaged as those who not only contribute ideas but also give their feedback on contributions of others.

Finally, in case of on-going community crowdsourcing events, engagement is also evaluated in relation to the current date of the event through the **recency** dimension. That is, the closer the participant’s contributions are to the current date of the event, the more engaged (s)he is judged to be. Our consideration of the recency of participant contributions is inspired by findings in marketing research. Marketing researchers showed that recency, or the length of time since the last purchase, was the most powerful predictor of the next purchase (Gupta et al., 2006; Wei et al., 2010). We expect a similar effect in community crowdsourcing. The more recent a participant’s contributions are, the more likely it is that the participant will contribute in the near future. Also, imagine two crowdsourcing events that have comparable levels of participant contributions, both in terms of magnitude, temporal intensity, and diversity. In the first event the majority of contributions took place several months ago while in the second event the majority of contributions happened during the last several weeks. It would be reasonable to declare that the second event *currently* enjoys a higher level of engagement.

The engagement of a participant can now be measured as the multiplication of the measures along the four dimensions. Multiplication, rather than addition, is used to reflect the fact that the temporal intensity, diversity, and recency of participant behaviour further qualify the magnitude of his/her behaviour.

#### 4 An example of measuring participant engagement in community crowdsourcing

To illustrate how the proposed participant engagement can be operationalized in a specific context, in this section we present the participant engagement index (PEI) that we developed to measure participant engagement on the community crowdsourcing platform MindMixer. MindMixer supports city halls and government offices to solve civic problems such as upgrading neighbourhood infrastructures, city hall budget plans, or improving government administrative operations. Upon the request of a client (i.e. city halls and government offices), MindMixer sets up a website and calls for online users' participation in online discussions on various topics requested by the client. Within a website (called a "project"), there may be multiple topics, which are issues for discussion or problems to solve.

As the first step to determine the PEI, we identify the *tangible effort online users voluntarily devote to what is requested in a community crowdsourcing initiative*. In the context of a MindMixer project, we can specify nine possible participants actions (i.e. behaviours or contributions): submitting an idea, submitting a comment, taking a poll, taking a survey, sharing a photo, rating an idea, sharing topics to friends, and referring the event to friends. Next, we measured the effort a participant exerted on these nine activities along the four dimensions (i.e. magnitude, temporal intensity, diversity, and recency) which are operationalized as the four sub-indices below:

**Participant Activity Engagement (PAE):** the PAE index reflects the magnitude of a participant's effort. It captures the number of times a participant performs any of the nine desired actions e.g. the number of idea submissions. Moreover, depending on the nature of the discussion topics, some activities may be perceived more significant than others. For example, in a brainstorming topic, submitting ideas may be considered more important than rating an idea, while in evaluation topics the contrary is true. Therefore, each action is also assigned a weight, or activity value to denote the relative significance of the action. The general formula to calculate PAE is presented below:

$PAE = \sum_{i=1}^9 an_i av_i$  where  $an_i$  = number of times action  $i$  is performed (in a week) and  $av_i$  = activity value of the action  $i$

**Participant Intensity Engagement (PIE):** We evaluate this temporal intensity through the PIE index, which has two components:

*The frequency aspect of the temporal intensity (Intensity Frequency):* Participants can contribute one day a week, or two days a week, or all seven days of a week – this is represented by intensity frequency. Higher the number of days a contribution was made, the higher the engagement is judged. This differentiation is denoted by the intensity frequency coefficient whose value is defined as follows in the MindMixer context: Contribute all 7 days – factor 1.25; 5-6 days – factor 1.00; 2-4 days – factor 0.75; 1 day – factor 0.50; 0 days – factor 0.

*The repetition aspect of the temporal intensity (Intensity Repetition):* For the days that the participant has contributed during the week, his or her contributions can range from once a day to several times a day. It is represented by intensity repetition coefficient. When participants contribute more than once a day, they are assigned higher weights. In the MindMixer context, the intensity repetition coefficient is specified as: Contributes once a day – factor 1.00; Contributes more than once a day – factor 1.25

The PIE is calculated as the product of the intensity frequency and intensity repetition. For example, a participant who contributed 3 days during the examined week, and contributed more than once in any of these three days, has a PIE of 0.75 (Intensity Frequency) x 1.25 (Intensity Repetition) = 0.94.

**Participant Diversity Engagement (PDE):** The diversity dimension is operationalized as the PDE index. In the context of MindMixer projects, the PDE values are determined as being equal to 1 if the participant performs only 1 activity type during the examined week, equal to 1.25 if the participant performs 2 to 6 of the possible activity types, and equal to 1.5 if the participant performs 7 or more.

For example, a participant who contributed two ideas, five comments, and rated seven ideas, has a PDE of 1.25 because (s)he performed three different activity types.

**Participant Recency Engagement (PRE):** The recency dimension is operationalized as the PRE coefficient, which assigns more weight for more recent contributions for a period of four weeks, in one week increments. Specifically, the contributions made within the first week before the current date are assigned the PRE score of 1.00; within the second week before the current date - 0.75; Third week - 0.50; Fourth week - 0.25.

**Participant Engagement Index (PEI):** Finally, the PEI score is the product of its four sub-indices. In the MindMixer context, the PEI is examined for a 4-week period. First, weekly PEIs are calculated for each week and then the PEI for the whole 4-week duration is taken as the average of the weekly PEIs. The formula for the PEI calculation is presented below:

$$\text{Weekly PEI Score} = \text{Weekly PAE Score} \times \text{Weekly PIE Score} \times \text{Weekly PDE Score} \times \text{Weekly PRE Score}$$

$$\text{4-week PEI} = \text{Average of the weekly PEI scores for the past four weeks}$$

Note that the 4-week PEI gives the engagement level of an individual participant in a community crowdsourcing project. To evaluate the participant engagement at the higher levels, such as topics, or projects, we take the sum of the individual PEIs from all the participants at the corresponding level e.g. adding all PEIs from the participants in a specific project to get the Project PEI. We rely on two assumptions to calculate the Project PEI and Topic PEI as such. First, the level of engagement, conceived as tangible and voluntary effort, is additive. That is, the engagement level of two participants is equal to the sum of the engagement levels of each of them. Second, besides individual engagement, a project or topic is considered more engaging if it can attract more participants.

## 5 An Illustration of PEI Utility

Our measure of engagement can be applied for different purposes. For example, it can be used as a yardstick for comparing the engagement levels of different projects at a particular point in time. To illustrate, the PEI was calculated for a particular date for a set of 6 MindMixer projects, thus giving insight in the engagement each project experienced over the past four weeks from that date. The results are depicted in Table 2. By calculating the Project PEI this way, historical data can be gathered that will assist in benchmarking certain engagement thresholds, while controlling for the number of active participants.

Project	Project PEI
EnvisionSacramento	59.4
YourVoiceVegas	16.0
LexEngage	15.9
EngageOakland	11.1
SpeakUpSierraVista	9.1
EngageOrlando	2.1

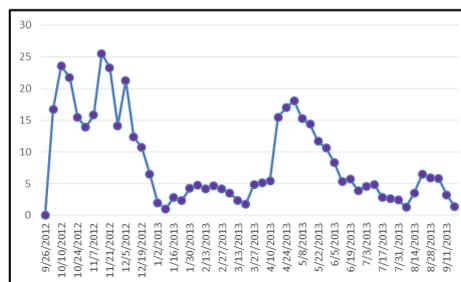


Table 2. Illustrative PEI scores.

Figure 1. Lifetime PEI for continuous engagement monitoring.

The PEI can also be used to monitor the changes in engagement level of a project, topic, or a participant over time. The PEI during the life of a project can be obtained by applying the formula on each 4-

week period of a project lifetime. Continuous monitoring of engagement in a project can help to find the rise and falls in the level of engagement and further track the causes of those changes. An example the lifetime PEI of a MindMixer project is given in Figure 1.

Finally, the PEI can also be used as a dependent variable to study the effect of various factors on engagement. For example, we examined the impact of feedback from project owners (in the form of comments from an admin user on a participant's idea) on participant engagement. For this analysis, we analysed 387 MindMixer projects, 56 of which had some level of feedback from project owners while the remaining did not. We calculated each project's engagement based on an aggregation of all individual PEI scores in the project. Using a non-parametric rank-ordered ANOVA test, we found that there was a significant difference in the project PEI for projects with feedback (Mean rank=222.07) and projects without feedback (Mean rank=189.25) conditions ( $p = .042$ ). Similar analyses on the topic level and participant level show that problem owner feedback has a significant positive effect on participant engagement.

## 6 Conclusions and expected contributions

Participant engagement is a critical determinant of crowdsourcing success. Yet, the conceptualization and measurement of the construct have not been sufficiently addressed in the crowdsourcing research community. We contribute to the literature by proposing a behavioural view of community crowdsourcing participant engagement. In particular, we propose to judge engagement by the quality of *tangible* and *volunteer* effort participants contribute to the crowdsourcing event. We argue that engagement judged from the behavioural viewpoint is of most relevance to crowdsourcing providers in the crowd-sourcing context. Further, while it may seem straightforward to gauge a participant's effort by their number of contributions to the crowdsourcing event, we argue for a more complex assessment of the quality of crowdsourcing engaging behaviours. That is, besides the *magnitude* of the effort, we also need to be attentive to its *temporal intensity*, *diversity*, and *recency*. The strengths of this complex view of behavioural engagement, besides being relevant to the crowdsourcing context, also lie in the fact that they can be captured quantitatively and easily through current web-logging metrics. We demonstrate this feasibility by describing the Participant Engagement Index (PEI) to measure the participant engagement in the specific context of MindMixer. While the PEI is tailor-made to the MindMixer, its development is suggestive to how to operationalize the participant engagement construct in other crowdsourcing instances. In addition, we illustrate the utility of a behavioural participant engagement index, either as an objective and quantitative indicator of participant engagement, or as a dependent variable for exploratory and confirmatory studies.

Our continued research activities include the following: First, we are validating the generalizability of the engagement definition and measurement in other community crowdsourcing contexts. Second, we are investigating the sensitivity of each PEI dimension separately. Finally, we are exploring whether there are additional dimensions that are required to characterize the quality of participant effort beyond the four dimensions discussed in this research in progress paper.

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