



## Research article

# Just participation or just participation? A participatory justice model for more successful theory of change design, implementation, and solution uptake

Julia Bello-Bravo<sup>a,\*</sup>, John William Medendorp<sup>b</sup>, Barry Pittendrigh<sup>c</sup><sup>a</sup> Department of Agricultural Sciences Education and Communication, Purdue University, West Lafayette, IN, USA<sup>b</sup> Department of Entomology, Purdue University, 901 W. State Street, Suite 105D, West Lafayette, IN, 47907, USA<sup>c</sup> Department of Entomology, Purdue University, West Lafayette, IN, USA

## ARTICLE INFO

## Keywords:

Participatory justice  
Fairness  
Empathy  
Cooperation  
Recognition  
Models  
Theory of change

## ABSTRACT

While a wide consensus acknowledges that participation is critical for the successful implementation of change that improves the livelihoods of people and communities around the world, justly securing that participation from stakeholders (at both the design and implementation stages) remains a demanding problem. This paper proposes a heuristic model for increasing participation that not only helps to investigate instances of nonparticipation but also opens up alternative intervention strategies and pathways for designers and implementers to consider toward more justly increasing participation and overcoming nonparticipation. Applied to a successful case of participation in Gurú District, Mozambique—where an 89% solution adoption of an improved postharvest seed storage method was measured two years after initial training—this paper demonstrates the key importance of designing opportunities and motivations for participation into any solutions or innovations but especially justice as a factor for successful realization of theory of change efforts (all the more so in developing nation contexts). Applied to a second case study, this paper also explores participation despite little to no motivation to do so. Aiming to afford designers and implementers of theory of change interventions a tool for more successfully and exactly matching innovation goals with innovation outcomes, the paper also addresses broader implications for the model within theory of change approaches generally.

## 1. Introduction

Development practitioners utilizing theory of change approaches (Prinsen and Nijhof, 2015; USAID, 2017; Vogel, 2012) understand that in order for locally adapted solutions to be successfully adopted, local participation is necessary. Based on empirically verified solution-adoption successes (Bello-Bravo et al., 2018a, 2020; Bello-Bravo and Pittendrigh, 2018), we argue in this paper that theory of change approaches can achieve greater solution adoption by focusing on *just participation* (Anderson, 1998; Daré et al., 2014; Mansuri and Rao, 2013; Mkutu et al., 2019). This applies even when, and perhaps especially when, steeply hierarchical relationships are in play, as can often be the case in international development (Lutomia et al., 2020).

Accordingly, this paper models a heuristic theory of change approach (TCA) that can be used especially by international development innovation-solution designers for increasing just participation

and subsequent solution-adoption. While this heuristic model does afford a relative-scale assessment of just participation, its intended use is (1) as a strategic design tool for realizing alternatives not typically considered when designing solutions and (2) thus more ably delivering both participation (as increased numbers of participants) and *just participation* (participation that achieves justice in participation) for projects. The “Framework” section below briefly summarizes the model and gives examples of how its use discloses alternative channels for just participation for excluded, overlooked, or disengaged participants.

Two points must be stressed at the outset. First, this heuristic model is presented as an action-based approach to the complex problem of engaging and eliciting action in populations that are historically challenging to reach. As a preliminary offer, it necessarily reflects a “subjectivity” of design that characterizes model design generally (Shiffrin and Nobel, 1997). Moreover, as a specifically heuristic

\* Corresponding author.

E-mail address: [mbellobr@purdue.edu](mailto:mbellobr@purdue.edu) (J. Bello-Bravo).

approach, the model by definition utilizes a simplified set of processing guidelines for problem-solving (usually based in previous experience) applicable to situations where complex or incomplete information makes a fully rationalized approach impossible or intractable (Ippoliti, 2015; Myers, 2010; Pearl, 1983), hence, it “provides a tool for responding to uncertain or ambiguous situations where the use of analytical reasoning would be impossible or impractical” (Kannengiesser and Gero, 2019, p. 3).

While Kannengiesser and Gero (2019) demonstrate the relevance and applicability of heuristic approaches to design processes, it is also always necessary to guard against cognitive biases and errors arising from the use of heuristics (Hauser, 2005) also without falling prey to overly functionalist assumptions in the model building and variables (Kannengiesser and Gero, 2019). One way to avoid these problems is to incorporate the design equivalents of qualitative research's multiple coder, inter-rater agreement, and conferencing techniques to resolve interpretive discrepancies (Burla et al., 2008; Gwet, 2014; Lange, 2017). These help to enhance the relevance and utility of this heuristic model's application in practice for any concrete, on-the-ground efforts and projects that aim at to elicit participation.

Second, the incorporation of the notion of justice into this heuristic model for eliciting participation represents a significant addition to the usual factors of *opportunity* and *motivation*. That is, looking primarily at opportunity and motivation as explanatory heuristics for participation and nonparticipation tends to miss any *qualities of interaction* that prevail in situations where people do or do not participate. The notion of *justice* (addressed in the next section) as used in this heuristic model takes account of and incorporates these otherwise often overlooked qualities of interaction as factors in designs that aim at eliciting participation.

### 1.1. Opportunity, motivation, justice

TCA frameworks generally call for solution designers to make their premises and assumptions clear (Funnell and Rogers, 2011; Vogel, 2012). For the TCA model proposed here, these assumptions include three core analytic variables: *opportunity*, *motivation*, and *justice*. As a design tool, the model's goal involves maximizing participant opportunity and justice (Hickey and Mohan, 2004; Waddington and Mohan, 2004). The variable of motivation, however, differs from the other two in that it can be both negative or positive. Negative motivation comes from situations in which fear, coercion, or a power differential is used to produce specific outcomes. Positive motivation, on the other hand, applies leverage that is based on autonomy and the best interests of the participant. In the case of this second variable, the function of the model is to maximize positive motivation while minimizing negative motivation. Also, none of these analytic variables are explicitly quantifiable but occupy a relative scale of weighting (greater than, less than, or roughly equal to). This is unavoidable but appropriate, since by definition no absolute scale for these elements can exist (Rasch, 1960); the only possible scale between them would be a relative one (Berka, 1983).

While *opportunity* generally captures external (environmental) factors, and *motivation* generally captures internal (psychological) factors, the third variable *justice* involves interactions between opportunity and motivation themselves—specifically, the prevailing *qualities of interaction* occurring between people in the participatory situation. These qualities of interaction reflect cultural values (e.g., fairness, empathy, cooperation, and recognition) that are valorized, honored, enforced, denigrated, or flouted when people and groups interact (Waldenfels, 2002). Rawls (1971) similarly described justice as circumstances in which (1) each person in a social system has an equal right to the most extensive total system of equal basic liberties compatible with a similar system of liberty for all, such that (2) any social and economic inequalities are arranged for the greatest benefit of the least advantaged (consistent with the just savings principle) and attached to offices and positions open to all under conditions of fair equality of opportunity (p. 266).

## 2. Framework: just participation model

This model aims to increase *just participation*. As an explicitly qualitative model, any assessment of it will involve how *usefully* (Box and Draper, 1987) it affords such just participation by and for solution designers and end-users in each concrete application. By *just participation* is meant *activity (at any scale) that increases participation in the social system such that all participant-actors find their participation sufficiently beneficial*. As Rawls (1971) notes, this goal does not guarantee equal benefit for all or that all actors got exactly what they wanted. Rather, it means that all participants find the resultant distribution of benefits from participating (for them and their community) *sufficiently just* (with all due caveats for the many complexities involved in any distributive justice context).

For brevity, we do not exhaustively motivate or define in advance how *opportunity*, *motivation*, and *justice* iterate through this TCA just participation model (in part, to get as quickly as possible to its illustrative case-study uses). Stated initially: given *opportunity* ( $O$ ), *motivation* ( $M$ ), and *justice* ( $J$ ), then *just participation* ( $P$ ) within a given social system is the aggregate of  $O$ ,  $M$ , and  $J$ , where  $P_{min}$  denotes the minimum necessary for generating participation by a person or group. Formulaically:

$$O + M + J \geq P_{min} \quad (1)$$

This initial formulation (refined more below) expresses the following: when a person or a group perceives that the aggregate of opportunity, motivation, and justice for a given activity within their social system meets the necessary minimum, then they will participate. Conversely, if  $P_{min}$  is greater than  $O + M + J$ , then the person or group will not participate in the activity, supporting design solutions such that  $O + M + J \geq P_{min}$  is a goal of this model. Also, following Taylor (2010), the model does not (and should not) assume in advance either any value for  $P_{min}$  or what any resultant form of activity will look like (i.e., constructive, resistive, supportive, or even sabotage).

Simply to give an introductory picture of how the model can look in action, consider the situation of an excellent and fair opportunity ( $O+J$ ) for participation that nevertheless faces enough inhibiting pressure to distort or preclude participation ( $-M$ ),  $O + J - M < P_{min}$ . Response biases in research exemplify cases of this (Wetzel et al., 2016), e.g., when researchers seek honest assessments of training programs or innovations from participants and (real or perceived) power dynamics in the situation inhibit accurate responses (Jann et al., 2019; Nederhof, 1985). One design alternative to address this would be to intentionally decrease fear, coercion, or power differentials by increasing some compensatory variable, e.g., ( $-M + k$ ), where  $k$  represents rapport, to offset this pressure (Markesich, 2008); hence,  $O - (M - k) + J \geq P_{min}$ . Alternatively, increasing opportunity by adding rapport ( $O + k$ ), through demonstrating a willingness to provide alternative forms of participation (e.g., digital access, special access for underrepresented groups, using local languages, creating non-threatening environments), would also increase participation, such that  $(O + k) - M + J \geq P_{min}$ .

The main strategic value of the model is that while an identified problem for participation may appear to center on one of the variables  $O$ ,  $M$ ,  $J$ , it invites consideration of other situational variables as intervention-points for increasing participation. Practical use of the model, however, requires further distinguishing at least two types of each variable, i.e., opportunity [ $O = O_I + O_U$ ], motivation [ $M = M_L + M_S$ ], and justice [ $J = J_F + J_N$ ] (see Table 1 for an explanation of each). Nothing precludes designers from further adding or refining distinctions. The model's usefulness is always the most relevant criterion.

For all variables, taking the two sub-variables together would ideally still be positive [e.g.,  $O_I + O_U > 0$ ], but when this is not the case, increasing one sub-variable to offset the other becomes a design possibility. For example, if a participant intends to participate ( $+O_I$ ), but an unforeseen circumstance ( $-O_U$ ) such as a lack of transportation prevents participation, this makes manifest the design decisions to (1) offer more

**Table 1.** Variables weighted within the model for just participation.

Variable	Definition
$P$	Participation in the system
$P_{min}$	Minimum threshold for participation in the system
$O$	Opportunity = $O_I + O_U$
$O_I$	Intentionally or deliberately pursued opportunities
$O_U$	Unintentional (fortunate or unfortunate) impacts on opportunity
$M$	Motivation, as pressure for participation = $M_L + M_S$
$M_L$	Long-term motivations or pressures
$M_S$	Short-term, immediate motivations or pressures
$J$	Justice (as fairness, empathy, cooperation, and/or recognition) = $J_F + J_N$
$J_F$	Formal, expected, or situationally conventional qualities of interaction
$J_N$	Non-formal, unexpected or situationally non-conventional qualities of interaction
$k$	Rapport, defined as harmonious relationships in which the people or groups involved make intentional efforts to understand each other and to reduce barriers to candor, authenticity, and trust

opportunities to participate, e.g., additional presentations of a training ( $O_I + k$ ) or (2) provide transportation to event-trainings for participants ( $- O_U + k$ ). That these possibilities become manifest does not guarantee they are feasible: there may not be days for more trainings, there may not be resources or logistics to get participants to events. Nevertheless, both represent design *alternatives* that better ensure that the opportunity to participate remains positive [whether as  $(O_I + k) - O_U > 0$ , or  $O_I - (O_U - k) > 0$ , respectively]. As such, as  $O$ ,  $M$ , or  $J$  approach zero [e.g.,  $|O_I + O_U| \approx 0$ ], these situations represent volatile, tipping-point situations where slight changes to the sub-variables may change  $O$ ,  $M$ , or  $J$  from positive to negative (or vice versa).

**2.1. Just participation**

When presenting cases to illustrate the use of this TCA just participation model, it is necessary to stress briefly its particular advantage. To this point, the model has taken cues from existing models for participation that incorporate opportunity and motivation as crucial factors (c.f., Siebert et al., 2006; Yoder et al., 2019). However, here our model departs from those by explicitly including justice ( $J$ ) as a third, indispensable factor. Justice captures any facilitating or inhibiting *qualities of interaction that arise between people and groups in a social setting* around participation. Justice is necessary because if we think only in terms of opportunity or motivation, we find situations in which both opportunity and motivation are positive yet fail to produce the expected participation—for example, when a person of a marginalized group fails to participate in an activity that provides opportunity for advancement and is positively incentivized, yet fails to meet a standard of justice (e.g., because it derives from historical injustices or occurs in a context of systemic racism). If we take into account only opportunity and motivation, the lack of participation will not be predicted by the model. Adding justice, however, allows us to provide a more complex assessment of situational factors that are not reducible to the individual in isolation.

Indeed, researchers, practitioners, and designers alike have recognized the need for (1) an explicitly facilitating role ( $+J_F$ ) that can offset any formal structural injustices within a culture ( $-J_F$ ) and (2) situational justice ( $+J_N$ ), in which situation-specific remedies can be sought when structural injustices are manifest in a specific activity ( $-J_N$ ), whether maliciously or ignorantly, by other participants—for example, when women sit in the back and are reluctant to speak up in a public gathering due to cultural norms or religious proscriptions (Bolitho and Bruce, 2017; Tochluk, 2010). In this way,  $J$  captures the “slope” of existing, hierarchical power dynamics and qualities of interaction in play (between gatekeepers, participants, and wider communities) in different social spaces. Consequently, the less negative the “slope” of  $J$ , the more fair,

empathetic, cooperative, or recognizing of others a specific situation is likely to be.

Combining these sub-variables, Eq. (1) can be rewritten as follows:

$$(O_I + O_U) + (M_L + M_S) + (J_F + J_N) \geq P_{min} \tag{2}$$

This can be expressed colloquially as follows: “if someone perceived that they could ( $O$ ), wanted to ( $M$ ), and were allowed ( $J$ ) to participate, then they did” (and its corollary: “if someone perceived that they could not, or did not want to, or were not allowed to participate, then they did not”). This applies to both people and groups.

**3. Model application & discussion**

**3.1. Case study: varieties of participation in a solution for food security and stock preservation using jerrycans in Mozambique**

Because food security for all people is a participatory justice issue (Altieri, 2004; United Nations, 2015), here we analyze a successful long-term change of behavior through participation in the solution-uptake of a novel jerrycan method for enhancing food security (Bello-Bravo et al., 2020).

**3.2. Background**

Mocumbe (2016) documents disseminating to 314 farmers in Gurú District, Mozambique an improved postharvest seed preservation method using jerrycans. Consistent with TCA, the solution’s conceptualization began in consultation with a focus group of farmers to articulate a problem to be solved; in this case, because the farmers could not generally afford to buy new seed for each growing season, they saved beans from the previous season, but suffered losses from weevils that would often destroy (or greatly impact) the stored stock. The solution subsequently identified involved using generally free and locally available 20 L plastic jerrycans to hermetically seal seed stock. Again with further local farmer participation, Mocumbe (2016) conducted a successful proof of the jerrycan storage concept over six months, which included farmers practicing the method themselves. An 8-step protocol was constructed for most securely storing the beans this way in jerrycans.

The next step involved empirically presenting the method to 314 Mozambican farmers. A short, animated video was produced by Scientific Animations Without Borders (SAWBO, 2020) illustrating the 8-step protocol. Mocumbe (2016) then tested four modes of delivering the protocol to farmers: (1) traditional extension teaching in groups of 20–25 people, (2) the use of the animated video (translated into the local dialect of Lomwe) watched by smaller groups of 3–4 people, who could watch the video as many times as they pleased and discuss the contents among themselves, and two sequences of (3) animated video first, then extension teaching, and (4) extension teaching first, followed by animation viewing. All of the approaches, except the traditional extension training, measured statistically significant knowledge gains. At a follow-up two years later, farmers who had previously viewed the video had a 97% knowledge retention and an 89% adoption of the jerry-can storage method (Bello-Bravo et al., 2020).

**3.3. Model analysis**

In the study situation initially addressed by Mocumbe (2016), focus-group farmers expressed strong short- and long-term motivations ( $+M = M_S + M_L$ ) to learn a potential solution to a problem they identified as directly affecting their livelihood (i.e., insecure seed storage for next-year’s planting). In other words, the solution provided outcomes that aligned with their autonomy and self-interests. However, this very strong motivation [ $|M_S + M_L|_{max} \gg 0$ ] required feasible solution opportunities. While a number of bean storage strategies were explored, the alternative utilizing jerrycans leveraged the free and locally readily

available materials, such that farmers could deliberately and easily pursue the opportunity ( $+O_I$ ) to implement the method after learning it, even if unforeseen circumstances affected their ability to participate ( $O_I - O_U > 0$ ). Importantly, the poor situational feasibility of other otherwise scientifically effective solution alternatives would have been enough to cancel an otherwise very strong motivation and preclude participation,  $-(O_I + O_U) + (M_S + M_L) + J \leq P_{min}$ . It is precisely for this reason that focus grouping can avoid such errors (Freeman, 2006; Gibbs, 1997).

As part of the subsequent broader innovation dissemination (to 314 farmers), if a farmer were fortunate enough to be selected to participate in the study and learn this method ( $+O + M + J > 0$ ), and no one undermined their access ( $-J_N$ ) to that training, then they would participate (see the noted exceptions below). Conversely, those who were equally able to participate and were motivated to do so ( $+O + M$ ) but were prevented from doing so by cultural or structural barriers, such as skewed selection criteria ( $-J_F$ ), then they would not participate (again, see the exceptions below).

Importantly, while the dissemination of the innovation in Mocumbe (2016) occurred justly—i.e., by recognizing and approaching all selected participants with equal fairness, empathetically utilizing the local and national languages to communicate, and grouping participants together to learn cooperatively ( $+J_N$ )—the process of participant selection itself did not achieve the same degree of justness ( $-J_F$ ). As is often the case with research in Africa, in each area where researchers offered the innovation, it was necessary to work with, and secure permission from, community leaders, both to perform the study itself and acquire initial lists of potential participants from those leaders.

In this initial list-making, which Mocumbe (2016) had no access to or control over, an element of unfairness ( $-J$ ) impacted who was and was not included for participation, by fiat of community gatekeepers (see Fleisher and Kriener, 2006 for an even more extreme example by literal gatekeepers at correctional institutions). Second, from those lists of potential participants, a smaller set of selected participants were then chosen using a random number generator to avoid selection bias methodologically. While methodologically sound, affording participation to some and not others by random selection is the very antithesis of fairness.

### 3.4. Gender inequalities

Despite the methodologically randomized inclusion of pre-selected participants, evidence of structural barriers to participatory access by gender (for women) were visible. Specifically, despite no statistically significant difference between women and men on the jerrycan innovation knowledge pre-test ( $p = 0.09$ ), for one mode of delivery (“animation viewing followed by extension teaching”), women’s post-test learning was statistically significantly lower than men’s ( $p = 0.041$ ). That is, when women farmers first viewed the jerrycan animation and then were present for an extension discussion of the video’s content afterward, their post-test learning scores were lower compared to men’s. This is in contrast to the other designed forms of delivery in Mocumbe (2016), which yielded no significant difference in post-test scores by gender. Nor is it clear how the extension session that followed animation viewing could have somehow “boosted” men’s learning or negatively “impacted” women’s learning. In other research, the “animation followed by extension teaching” approach has measured the highest degree of knowledge transfer compared to other approaches (Bello-Bravo et al., 2018). The designed intention for having a post-viewing facilitated discussion is that it affords a public opportunity for facilitators to answer questions, clarify potential misunderstandings of the training (arising from the video), and even demonstrate the training (Bello-Bravo et al., 2018).

Acknowledging all due caveats (including the need for future research to replicate this outcome), the just participation model helps shed light on why the expected result may not have occurred. For one, women’s generally decreased access to education in Africa ( $-J_F$ ) also impacts their participation in extension (educational) contexts as well (Mtshali,

2000), [ $-O + M + (-J_F - J_N) < P_{min}$ ]. Moreover, even when women are allowed to participate, they often are expected to do so (or perceive an expectation to do so) in a manner that does not challenge the status quo of men, which restricts their opportunities for participation and interaction (Mbo’o-Tchouawou & Colverson, 2014; Sadaf et al., 2005; Tiwari, 2018; Umata et al., 2011), [ $O + M - (J_F + J_N) < P_{min}$ ].

It is not yet clear from this analysis whether women’s nonparticipation (or decreased participation) arises from formal injustice norms that disadvantage women and girls in education generally ( $-J_F$ ) (Kelly, 1988) or situationally specific qualities of interaction during the study that discouraged women’s participation despite being present [ $(J_F - J_N) < P_{min}$ ], if not both. This lack of clarity inhibits effectively designing an alternative (to say nothing of “solving” or “working around” the existing injustice norms), but because the teaching setting in this case seems to be the “site” of the problem, varying the opportunity ( $O + k$ ) becomes visible as one way to increase participation [ $(O + k) + M - (J_F + J_N) \geq P_{min}$ ]. Most straightforwardly, this would involve leveraging the benefits of gender-separated teaching (Viets, 2009; Zeid and El-Bahey, 2011). Such an alternative might not have been feasible or too logistically onerous to implement. It might also, for some designers, have already been obviously needed and already incorporated into their design. The strategic value of the model is only and always to afford a view of the spots in a designed solution-innovation where opportunities for more just and increased participation may not necessarily be evident in the foreground.

### 3.5. Beyond the participant/nonparticipant binary

Community participation and nonparticipation in Mocumbe (2016) occurred in several types; namely, (I) gatekeepers empowered to make decisions about who was or was not authorized to participate, (II) those authorized to participate who did, (III) those not authorized to participate who did not, (IV) those who, despite being authorized to participate, nevertheless did not and sent no proxy on their behalf, (V) those who, though not authorized to participate, attempted to do so anyway and were permitted to observe the training, (VI) those authorized to participate who did not, but sent a proxy in their stead, (VII) those not originally designated to participate but who nonetheless did due to a variance in sampling method, and (VIII) those not visible to the study in any way.

From a strictly methodological point of view, sampling processes motivate whether a visible community member is or is not qualified for inclusion in a study (Davoudi et al., 2017), but innovation and educational studies never arise in a vacuum bracketed off from their surrounding communities (Griffin, 2021). Whatever the situational factors in play [ $(O_I + O_U)$ ] for participant selection, some people will already be perceived by gatekeepers as selectable ( $+J_F$ ) or not ( $-J_F$ ). As an impact on participation, fairness of access to training and perceptions around how access to that training is managed are crucial with respect to whether participation toward training goals occurs (Bartlett and Kang, 2004; Bulut and Culha, 2010; Salas et al., 2012). As such, the “politics” of the community gatekeepers’ predetermination of certain classes of potentially selectable and excludable community members becomes one of the qualities of interaction ( $-J_F$ ) in the background of the study. Without considerable familiarity with an area of study, even seeing this background (much less being able to design around it) becomes extremely difficult.

In general, the two most typical classes of participants are Type II (those who were chosen by both the gatekeepers and randomization process to participate and did so) [ $O + M - J \geq P_{min}$ ] and Type III (those who were excluded from participation by gatekeepers and did not attempt to) [ $-O - J < P_{min}$ ]. The model remains “agnostic” about motivation here. All that is known is that an injustice and a lack of opportunity were enough to preempt participation. Specifically, it is crucial to note this because Type V participants were formally excluded from participation by gatekeepers and the randomization process ( $-J$ ) but

nevertheless pursued an opportunity to attend local training events ( $O_I$ ) and were able to participate, albeit in an indirect way as observers only (i.e., without being included in the data collection). [Symbolically:  $(O_I - O_U) + M - J \geq P_{min}$ , where  $-|O_I - O_U + M| > -J$ ]

Some research could describe this kind of Type V participation (of showing up when not otherwise being permitted to do so) in terms of motivation ( $+M$ ), i.e., as grit, perseverance, determination, or some other valorized psychological aspect of *character* (Duckworth, 2016; Tough, 2012). Such an analysis may disregard or not give adequate weight to any situational ( $O$ ) or sociocultural ( $J$ ) factors that enable or inhibit the social practice of such grit, proactivity, or self-determination in the first place (Desai, 2017; Sanya, 2017). It may also imply, unjustly, that those *not* enabled to practice such character aspects—of gumption, stick-to-itiveness, or grit—were *rightly* excluded (i.e., *deserved* to be excluded from participation) (Huber, 2016). It further implies, whether unfairly or not, that Type III *nonparticipants* might not have tried hard enough to participate (or would have if they had simply tried harder).

Such a view does not give enough weight to how women, people of color, the poor, and others historically have been excluded from countless activities in the social world despite opportunities and strong motivations to participate (Ahmed, 1996). In Mocumbe (2016), the fact that nonofficial participants were allowed to observe the training ( $+J_N$ ) illustrates an on-the-fly design alternative that offset an otherwise circumstantial unfairness in the study,  $[(O_C + k) + (J_N - J_F) > 0]$  Another possible offset would be to build into the intervention-design a support for participants to share what they learned with nonparticipants This informalized train-the-trainer approach (Pearce et al., 2012) was a designed-for outcome of the study; at a two-year follow-up, “Among the 104 participants overall, 96 (92.3%) also reported telling an average 8.49 other farmers about the postharvest bean storage technique, while 57 (54.8%) reported demonstrating the technique to an average 6.35 others” (Bello-Bravo et al., 2020, p. 6).

Thinking only in terms of motivation also becomes problematic for Type IV and VI participants (those who were authorized to participate but declined to do so either entirely or only through a proxy). Practically speaking, it may well be that the opportunity to participate was too inconvenient [ $-O_U + O_I < 0$ ] or upstaged by unforeseen events [ $O_I - O_U < 0$ ]; not every invitee always attends. Nevertheless, while entrepreneurial discourse (Duckworth, 2016; Tough, 2012) can valorize the grit, perseverance, or strength of character of those who (without permission) showed up or sent someone in their stead, that same lens can frame those who declined the invitation as lazy, unintelligent, lacking in character (Gevisser, 2009; Putland et al., 2011; Terui and Hsieh, 2016), or liable to the judgment, “I can’t help these people if they don’t want to help themselves” (Mason and Butler, 2010, p. 4). Substantial situational factors often inhibit participation (Paley, 2015). Rather than ascribing nonparticipation to a demotivated character defect, the just participation model highlights the opportunity for solution designers and producers to reflect whether the participation offered risks being irrelevant, unfeasible, or culturally out of line with people’s motivations ( $-M_L, -M_S$ ).

Mocumbe (2016) reported surprise that people might not want to participate at all (Type IV) but also highlighted the inconvenience of having to select replacement participants for those who did not show up at all. The data from Mocumbe (2016) does not specify the numbers of these replacements but notes that when participants did not show up, the gatekeepers simply selected from their lists of potential participants without using the random number generator. In the model, this represents an exception ( $+J_N$ ) to the otherwise unfair rule ( $-J_F$ ) that afforded access only randomly. Thus, some who failed initially to be selected for participation (due to losing the random lottery) became participants after all [ $-J_F + J_N > 0$ ].

While nepotism represents a common type of this participatory exception to access (Zalanga, 2018), unfairness around gatekeeper-granted access to social opportunities can have a chilling effect on participation (Salas et al., 2012). Here again, the willingness to allow observational

participation to otherwise excluded people ( $+J_N$ ) marks a powerfully corrective design alternative to offset (real or perceived) nepotism or favoritism.

### 3.6. Case study: eliciting unlikely participation in Ghana

While conducting other formal research in Ghana around pre-test/post-test learning gains from viewing educational animations (Bello-Bravo et al., 2017), the researchers took advantage of opportunities to organize *ad hoc*, informal training: specifically, (1) presenting the jerrycan method described in the previous case to cocoa farmers, and (2) sharing that video with bean marketwomen in their workplace. Videos were presented in participants’ mother-tongue, but no testing occurred. All data are drawn from researcher observations.

Unlike in Mocumbe (2016), where participant farmers first identified a critical problem (postharvest inventory loss) and then helped identify a solution feasible for solving that problem, here the *ad hoc* participants either had no use for the jerrycan solution (the storage needs problems of Ghanaian cocoa farmers are not the same as those faced by Mozambican farmers) or saw no need for an improved postharvest storage system (despite bean marketwomen in Ghana losing stock due to open storage bags, rodent and insect predation, and spoilage from moisture). As such, while the farmers in Mocumbe (2016) had very strong short- and long-term motivations for taking up the jerrycan solution [ $|M_S + M_L|_{max} \gg 0$ ], the motivation for the Ghanaian cocoa farmers and bean marketwomen to participate in learning the jerrycan method would seem to be zero [ $|M_S + M_L| \approx 0$ ].

And yet, they participated in the offerings [ $(O_I + O_U) + 0 + (J_F + J_N) \geq P_{min}$ ]. For both instances, the opportunistic *convenience* ( $+O_U$ ) of the offerings played a crucial role (Yale and Venkatesh, 1986). Of note, much of the existing convenience theory research concerns criminal behavior, where an opportunity elicits motivated behavior in part due to the perceived advantages that committing the criminal behavior affords (Gottschalk, 2018; Stadler and Gottschalk, 2021; Yasir et al., 2021). In the present case studies, however, if motivation appears merely from the opportunity of the offer, it seems not to arise from the content, since neither the cocoa farmers nor bean marketwomen had any interest or use for that content. That is, neither group likely saw any advantage to participating in the jerrycan method presented.

For the community of practice of Ghanaian cocoa farmers (Wenger, 1998a; 1998b), a perpetual curiosity and search for improvements to, and deepening mastery of, farming might have been enough to overcome an otherwise general non-interest in the opportunity to view otherwise conveniently not-relevant content [ $|M_L - O_I| > 0$ ]. However, the participants’ preexisting relationship with one researcher as part of the formal research study afforded extending an invitation to participants anyway ( $+O_U$ ) and also generally reflected a positive quality of interaction ( $J_F + J_N) > 0$  between the researcher and the participants. That is, because the offer of additional teaching was a goodwill offer in support of the wellbeing of the cocoa farmers, despite the unlikelihood that that information would be of direct advantage to them, they nevertheless felt moved to accept the invitation. Here, the apparent motivation elicited by the opportunity arises less from an immediate self-advantage ( $+M$ ) and more from a rapport and particular positive stance taken by the researcher and perceived by the participants (Barnaud et al., 2014; Daré et al., 2014; Lutomia et al., 2020; Sull, 2014; Zheng et al., 2021). As a design alternative, attention to qualities of interactivity is arguably essential for achieving actually sustainable positive outcomes going forward, especially cross-culturally under the shadow of climate change and future global pandemics (Eisler, 2021; Étienne, 2014; Lutomia, 2019; Madela, 2020).

For the bean marketwomen, the quality of interaction element is more visible. Although physically presenting women in the marketplace with a mobile phone preloaded with the jerrycan video represents a maximally convenient and unexpected opportunity ( $+O_U$ ), the setting itself—in a busy and noisy market during the women’s workday, while they are

tending to customers, chatting with friends, and taking care of children in the stalls —verges on the antithesis of a favorable learning environment [ $(-O_I + O_U < 0)$ ]. Moreover, unlike the cocoa farmers who had no particularly positive or negative invested interest in a topic that at best only abstractly touched on their lives as farmers, the bean marketwomen were already positively invested in their existing postharvest storage method (faulty though it might be, as they would readily acknowledge) and saw no need to inconvenience themselves with an alternative, even if it might be more effective in the longer term [ $(-M_S + M_L < 0)$ ]. In Rawls' (1971) terms, they were satisfied with the distribution of current benefits as they stood.

Again, the maximal convenience of presenting the videos for the marketwomen's viewing at their leisure was necessary (if still not sufficient) to support their participation. This convenience included mobile-phone viewing itself (Bello-Bravo et al., 2020; Maredia et al., 2018), which affords straightforward watching, stopping, pausing, and rewinding as necessary, especially when constantly interrupted by customers, friends, and children. Demonstrating the video playback function to the women also made manifest to them the fact that the videos were presented in their mother-tongue (rather than the "national" language of Ghana, English). Here as in numerous other studies on mobile-phone videos for learning (Bello-Bravo et al., 2013a; Bello-Bravo et al., 2013b; Bello-Bravo and Pittendrigh, 2012, 2018; Bello-Bravo et al., 2018), the women remarked on the novelty of and fascination with hearing media in their mother-tongue for the first time in their life.

Addressing a person in a way that they can better understand—and, conversely, not addressing people in a way that they more poorly understand—affords a better opportunity (+ $O$ ) and is fundamentally more respectful (+ $J$ ), i.e., fair, empathizing, cooperative, and recognizing. Taken together, these aspects not only surpassed disinterest in the video's content ( $-M$ ) but also caught the attention of other people in the market, who clustered together to participate in viewing the video. Whether the novelty and appeal here is more technological or cultural is indeterminable and moot. Ribot and Peluso (2003), in their theory of access, underscore how *availability* itself does not yet constitute *access*; people must also be able to put availability to use. Placing the videos both on the most technologically familiar ICT access device (Bello-Bravo et al., 2021) and in the would-be participants' most comfortably spoken language enabled not only availability, but access. That digital media (i.e., educational animations presented on mobile phones) can offer a design alternative embodying *justice* recalls McLuhan's (1964) *the medium is the message*, while also underscoring how including these in designs affords participants an increased use-opportunity, even in a demotivated setting almost optimally antithetical to learning.

### 3.7. Implications

End-users of this heuristic model might fruitfully assign different relative weighting of values to the model variables above. This is a strength, not a weakness, of this TCA model as its flexibility enables, even invites, generating multiple end-user viewpoints on any given social setting chosen for a solution analogously to qualitative research's use of multiple coders, inter-rater agreement, and conferencing techniques to enhance validity (Burla et al., 2008; Gwet, 2014; Lange, 2017). However, this flexibility also more broadly enables adding, removing, or nuancing the variables (as seen fit) to match the situation being analyzed (Kannengiesser and Gero, 2019). This aligns with the suggestion from Pólya (1945) to try visually representing an otherwise seemingly intractable problem, as one way to move toward possibly generating a solution. That end-users of this model can (and should) modify the equation of this model illustrates one form of such visual representation. At the same time, however, the ultimate benchmark for the model's usefulness (Box, 1979) is the extent to which it successfully and maximally elicits just participation over the course of any given design project.

This emphasis and operationalization of multiple viewpoints reflects a well-established, recognized, and effective design principle currently

used across a broad spectrum of fields, including scientific verification, software applications and artificial intelligence, decision-making and group problem-solving, conflict resolution, and educational settings (Benoliel, 2001; Brooks, 2016; Dunne et al., 2015; Étienne, 2014; Kannengiesser and Gero, 2019; Mallinger, 1999; Thomas et al., 2000; Wu et al., 2014). A requirement to take account of multiple viewpoints in general, in fact, may be an obligatory, if not an ontological, fact of human interaction itself (Kovbasyuk and Blessinger, 2013; Rankin, 2017).

By representing the model in an "algebraic" formulation, this proposal makes explicitly visible to solution designers the situational ( $O$ ), personal ( $M$ ), and socio-transactional/justice-based ( $J$ ) influences and alternatives available within a given social setting that might otherwise disappear into the background. Consequently, different configurations of  $O$ ,  $M$ , and  $J$  would not only potentially disclose other forms of participation and nonparticipation but also bring out different leverage points for increasing just participation when  $O + M + J \geq P_{min}$ .

## 4. Conclusion

As both experienced international development practitioners as well as theorists and scientists, we are acutely aware that participatory models can overlook explicit questions of justice or fail to operationalize it in a way such that it "has teeth." Understanding justice in light of the *qualities of interaction that prevail in a social setting*, this discloses its linkage to theory of change emphases on "the wider systems and actors that influence it" (James, 2011, p. 3). Where the system changes proposed by TCAs fail to take root (due to nonparticipation) such that a status quo persists, this signals that just *some* participation has been achieved but not yet *just participation*. The intervention will risk having benefitted only some, and very often the *some* who always get access to benefits (i.e., "business as usual"). If this is not a satisfactory distribution of elements for all stakeholders (Rawls, 1971), then there is more that remains to be done by the project.

The call for justice this implies is not only a moral imperative. As efforts to contain an epidemic like COVID19 demonstrate, anything less than 100% participation risks wider and more harmful effects from the disease. In this way, a call for just participation is every bit as pragmatic (and numerical) as it is moral; for every innovation provision and adoption, the target should be 100% participation, whether we (can) actually reach that or not.

The TCA model described in this paper affords solution designers and providers alike with a flexible, adaptable, and resilient lens for exploring and identifying other design solution pathways that will alternatively (if not also more cost-effectively and easily) drive toward desired solution outcomes while increasing participation. Above all, this means trying it out in practice, adapting it as necessary. The end result of the model's use intends a more complete threefold-bottom line alignment of solution outcomes with solution goals (1) with resources more cost-effectively spent (less overhead and waste), (2) more recipient solution-uptake or innovation adoption (greater reach and end-user long-term commitment to the solution), and (3) problems more redressed, if not eliminated entirely, in communities where the solution was needed (increased community well-being and political stability).

## Declarations

### Author contribution statement

Julia Bello-Bravo and Barry Pittendrigh: Conceived and designed the experiments; Analyzed and interpreted the data; Wrote the paper.

John William Medendorp: Analyzed and interpreted the data; Wrote the paper.

### Funding statement

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

**Data availability statement**

No data was used for the research described in the article.

**Declaration of interests statement**

The authors declare no conflict of interest.

**Additional information**

No additional information is available for this paper.

**References**

- Ahmed, S., 1996. Moving spaces: black feminism and post-colonial theory. *Theor. Cult. Soc.* 13 (1), 139–146.
- Altieri, M.A., 2004. *Genetic Engineering in Agriculture: the Myths, Environmental Risks, and Alternatives*, second ed. Food First Books, Oakland, CA.
- Anderson, G.L., 1998. Toward authentic participation: deconstructing the discourses of participatory reforms in education. *Am. Educ. Res. J.* 35 (4), 571–603.
- Barnaud, C., d'Aquino, P., Daré, W.s., Fourage, C., Mathevet, R., Trébuil, G., 2014. Power asymmetries in companion modelling processes. In: Étienne, M. (Ed.), *Companion Modelling: A Participatory Approach to Support Sustainable Development*. Springer, Dordrecht, Netherlands, pp. 127–153.
- Bartlett, K., Kang, D.-s., 2004. Training and organizational commitment among nurses following industry and organizational change in New Zealand and the United States. *Hum. Resour. Dev. Int.* 7 (4), 423–440.
- Bello-Bravo, J., Abbott, E., Mocumbe, S., Mazur, R., Maria, R., Pittendrigh, B.R., 2020. An 89% solution adoption rate at a two-year follow-up: evaluating the effectiveness of an animated agricultural video approach. *Inf. Technol. Dev.* 26 (3), 577–590.
- Bello-Bravo, J., Brooks, I., Lutomia, A.N., Bohonos, J.W., Medendorp, J., Pittendrigh, B.R., 2021. Breaking out: the turning point in learning using mobile technology. *Heliyon* 7 (3), e06595.
- Bello-Bravo, J., Dannon, E., Agunbiade, T., Tamò, M., Pittendrigh, B.R., 2013. The prospect of animated videos in agriculture and health: a case study in Benin. *Int. J. Educ. Dev. using Inf. Commun. Technol. (IJEDICT)* 9 (3), 4–16.
- Bello-Bravo, J., Huesing, J., Boddupalli, P.M., Goergen, G., Eddy, R., Tamò, M., Pittendrigh, B.R., 2018. IPM-based animation for Fall Armyworm: a multi-institutional and virtual international collaboration using the scientific animations without borders (SAWBO) platform. *Outlooks Pest Manag.* 29 (5), 225–230.
- Bello-Bravo, J., Lutomia, A.N., Abbott, E., Mazur, R., Mocumbe, S., Pittendrigh, B.R., 2020b. Making agricultural learning accessible: examining gender in the use of animations via mobile phones. In: Khosrow-Pour, M., Clarke, S., Jennex, M.E., Antiroiko, A.-V. (Eds.), *Environmental and Agricultural Informatics: Concepts, Methodologies, Tools, and Applications*. IGI, Hersey, PA, pp. 716–736.
- Bello-Bravo, J., Lutomia, A.N., Pittendrigh, B.R., 2017. Information literacy to prevent bean losses using animated videos: a pilot study of women entrepreneurs in Cape Coast, Ghana. *Glob. J. Environ. Sci. Technol.* 5 (3), 445–459.
- Bello-Bravo, J., Nwakwasi, R., Agunbiade, T.A., Pittendrigh, B.R., 2013. Perceptions of cell phone animations as an educational tool: a case study in southeastern Nigeria. *Int. J. Inf. Commun. Technol.* 3 (12), 308–315.
- Bello-Bravo, J., Pittendrigh, B.R., 2012. Scientific Animations without Borders: a new approach to capture, preserve and share indigenous knowledge. *J. World Univ. Forum* 5 (2), 11–20.
- Bello-Bravo, J., Pittendrigh, B.R., 2018. Scientific animations without borders (SAWBO): animating IPM information and education everywhere. *Outlooks Pest Manag.* 29 (2), 58–61.
- Bello-Bravo, J., Tamò, M., Dannon, E.A., Pittendrigh, B.R., 2018b. An assessment of learning gains from educational animated videos versus traditional extension presentations among farmers in Benin. *Inf. Technol. Dev.* 24 (2), 224–244.
- Bello-Bravo, J., Zakari, O.A., Baoua, I., Pittendrigh, B.R., 2018c. Facilitated discussions increase learning gains from dialectically localized animated educational videos in Niger. *Inf. Technol. Dev.* 24 (2), 1–25.
- Benoliel, J.Q., 2001. Thanatology and human rights. *Illness Crisis Loss* 9 (1), 8–14.
- Berka, K., 1983. Measurement: its Concepts, Theories, and Problems. In: Riska, A. (Ed.), *Reidel*, Boston, MA.
- Bolitho, J., Bruce, J., 2017. Science, art and alchemy: best practice in facilitating restorative justice. *Contemp. Justice Rev.* 20 (3), 336–362.
- Box, G.E., 1979. Robustness in the strategy of scientific model building. In: Launer, R.L., Wilkinson, G.N. (Eds.), *Robustness in Statistics*. Academic Press, New York City, NY, pp. 201–236.
- Box, G.E., Draper, N.R., 1987. *Empirical Model-Building and Response Surfaces*. John Wiley & Sons, Hoboken, NJ.
- Brooks, S.F., 2016. *Examining the Implementation Challenges of Project-Based Learning: A Case Study*. (MA). University of Maryland, College Park, MD.
- Bulut, C., Culha, O., 2010. The effects of organizational training on organizational commitment. *Int. J. Train. Dev.* 14 (4), 309–322.
- Burla, L., Knierim, B., Barth, J., Liewald, K., Duetz, M., Abel, T., 2008. From text to codings: intercoder reliability assessment in qualitative content analysis. *Nurs. Res.* 57 (2), 113–117.
- Daré, W., Barnaud, C., d'Aquino, P., Étienne, M., Fourage, C., Souchère, V., 2014. The commodian stance: interpersonal skills and expertise. In: Étienne, M. (Ed.), *Companion Modelling: A Participatory Approach to Support Sustainable Development*. Springer, Dordrecht, Netherlands, pp. 41–67.
- Davoudi, N., Nayeri, N.D., Raiesifar, A., Poortaghi, S., Ahmadian, S., 2017. Issues of theoretical sampling: a narrative review. *Nurs. Midwif. Stud.* 6 (2), 9.
- Desai, K., 2017. *Girlscape: Transnational Productions of Neoliberal Girlhoods*. (PhD). Teachers College, New York City, NY.
- Duckworth, A.L., 2016. *Grit: the Power of Passion and Perseverance*. Simon & Schuster, New York City, NY.
- Dunne, P.E., Dvořák, W., Linsbichler, T., Woltran, S., 2015. Characteristics of multiple viewpoints in abstract argumentation. *Artif. Intell.* 228, 153–178.
- Eisler, R., 2021. The commons and education for cultural transformation: a conversation with Aftab Omer & Melissa Schwartz. *Interdisc. J. Partner. Stud.* 8 (2), 2, 2.
- Étienne, M. (Ed.), 2014. *Companion Modelling: A Participatory Approach to Support Sustainable Development*. Springer, Dordrecht, Netherlands.
- Fleisher, M.S., Krienert, J.L., 2006. *The Culture of Prison Sexual Violence*. US Department of Justice, Washington, DC.
- Freeman, T., 2006. 'Best practice' in focus group research: making sense of different views. *J. Adv. Nurs.* 56 (5), 491–497. <http://onlinelibrary.wiley.com/doi/10.1111/j.1365-2648.2006.04043.x/abstract>.
- Funnell, S.C., Rogers, P.J., 2011. *Purposeful Program Theory: Effective Use of Theories of Change and Logic Models*. Jossey-Bass, San Francisco, CA.
- Gevisser, M., 2009. *A Legacy of Liberation: Thabo Mbeki and the Future of the South African Dream*. Macmillan, New York City, NY.
- Gibbs, A., 1997. Focus groups. *Soc. Res. Update* 19 (8), 1–8.
- Gottschalk, P., 2018. Empirical study of convenience theory: a student elicitation on white-collar crime. *Deviant Behav.* 39 (6), 747–757.
- Griffin, G., 2021. Feminizing innovation: challenges in science and technology studies (STS). *Femin. Encoun.* 5 (2), 24.
- Gwet, K.L., 2014. *Handbook of Inter-rater Reliability: the Definitive Guide to Measuring the Extent of Agreement Among Raters*, fourth ed. Advanced Analytics, LLC, Gaithersburg, MD.
- Hauser, M.D., 2005. Sunstein's heuristics provide insufficient descriptive and explanatory adequacy. *Behav. Brain Sci.* 28 (4), 553–554.
- Hickey, S., Mohan, G., 2004. Participation—from tyranny to transformation?. In: *Exploring New Approaches to Participation in Development*. Zed, London, UK.
- Huber, L.P., 2016. Constructing "deservingness": DREAMers and central American unaccompanied children in the national immigration debate. *Assoc. Mex. Am. Educ.* 9 (3).
- Ippoliti, E. (Ed.), 2015. *Heuristic Reasoning: Studies in Applied Philosophy, Epistemology and Rational Ethics*. Springer International Publishing, Cham, CH.
- James, C., 2011. *Theory of Change Review: A Report Commissioned by Comic Relief*. Comic Relief, London, UK.
- Jann, B., Krumpal, I., Wolter, F., 2019. Social desirability bias in surveys—collecting and analyzing sensitive data. *Meth. Data Anal.* 13 (1), 3–6.
- Kannengiesser, U., Gero, J.S., 2019. Design thinking, fast and slow: a framework for Kahneman's dual-system theory in design. *Des. Sci.* 5 (2019), e10.
- Kelly, A., 1988. Gender differences in teacher-pupil interactions: a meta-analytic review. *Res. Educ.* 39 (1), 1–23.
- Kovbasyuk, O., Blessinger, P., 2013. Fostering intercultural dialogue via communication technologies. In: Kovbasyuk, O., Blessinger, P. (Eds.), *Meaning-Centered Education*. Routledge, New York City, NY, pp. 89–105.
- Lange, R.T. (Ed.), 2017. *Inter-rater Reliability*. Springer, New York City, NY.
- Lutomia, A.N., 2019. *A Case Study of Successes and Challenges in a Scientific Collaboration Program Based in the United States and Benin*. (PhD). University of Illinois Urbana-Champaign, Urbana, IL.
- Lutomia, A.N., Bello-Bravo, J., Medendorp, J., Pittendrigh, B.R., 2020. A positive project outcome: lessons from a non-dominant government university-based program. *Interdisc. J. Partner. Stud.* 7 (2), Article 3.
- Madela, L.M., 2020. *Perspectives on South-North Institutional Collaboration/partnership Research in Higher Education*. University of Illinois Urbana-Champaign, Urbana, IL (PhD).
- Mallinger, M., 1999. The endowment decision: an exercise in negotiation and conflict management. *J. Manag. Educ.* 23 (5), 607–617.
- Mansuri, G., Rao, V., 2013. *Localizing Development: Does Participation Work?* World Bank, Washington, DC.
- Maredia, M.K., Reyes, B., Ba, M.N., Dabire, C.L., Pittendrigh, B.R., Bello-Bravo, J., 2018. Can mobile phone-based animated videos induce learning and technology adoption among lowliterate farmers? A field experiment in Burkina Faso. *Inf. Technol. Dev.* 24 (3), 1–32.
- Markesich, J., 2008. *Surveying Persons with Disabilities: A Source Guide*. Cornell University Rehabilitation Research & Training Center on Disability Demographics & Statistics, Ithaca, NY.
- Mason, P., Butler, C.C., 2010. *Health Behavior Change: A Guide for Practitioners*. Elsevier Health Sciences, Edinburgh, UK.
- Mbo'o-Tchouawou, M., Colverson, K.E., 2014. Increasing Access to Agricultural Extension and Advisory Services: How Effective Are New Approaches in Reaching Women Farmers in Rural Areas? *International Livestock Research Institute (ILRI)*, Nairobi, Kenya.
- McLuhan, M., 1964. *Understanding media: the Extensions of Man*. McGraw-Hill, New York City, NY.
- Mkutu, K., Mkutu, T., Marani, M., Ekitela, A.L., 2019. New oil developments in a remote area: environmental justice and participation in Turkana, Kenya. *J. Environ. Dev.* 28 (3), 223–252.

- Mocumbe, S., 2016. Use of Animated Videos through mobile Phones to Enhance Agricultural Knowledge Among Bean Farmers in Gurù District, Mozambique. (MS). Iowa State University, Ames, IA.
- Mtshali, S.M., 2000. Monitoring and evaluation of women's rural development extension services in South Africa. *Dev. South Afr.* 17 (1), 65–73.
- Myers, D.G., 2010. *Social Psychology*, tenth ed. McGraw-Hill, New York City, NY.
- Nederhof, A.J., 1985. Methods of coping with social desirability bias: a review. *Eur. J. Soc. Psychol.* 15 (3), 263–280.
- Paley, J., 2015. Absent bystanders and cognitive dissonance: a comment on Timmins & de Vries. *Nurse Educ. Today* 35 (4), 543–548.
- Pearce, J., Mann, M.K., Jones, C., Van Buschbach, S., Olf, M., Bisson, J.L., 2012. The most effective way of delivering a train-the-trainers program: a systematic review. *J. Continuing Educ. Health Prof.* 32 (3), 215–226.
- Pearl, J., 1983. *Heuristics: Intelligent Search Strategies for Computer Problem Solving*. Addison-Wesley, New York City, NY.
- Pólya, G., 1945. *How to Solve it: A New Aspect of Mathematical Method*. Princeton University Press, Princeton, NJ.
- Prinsen, G., Nijhof, S., 2015. Between logframes and theory of change: reviewing debates and a practical experience. *Dev. Pract.* 25 (2), 234–246.
- Putland, C., Baum, F.E., Ziersch, A.M., 2011. From causes to solutions: insights from lay knowledge about health inequalities. *BMC Publ. Health* 11 (1), 67.
- Rankin, A., 2017. Learning to think like a Jain. In: Shah, A.K., Rankin, A. (Eds.), *Jainism and Ethical Finance: A Timeless Business Model*. Routledge, New York City, NY, pp. 33–52.
- Rasch, G., 1960. *Probabilistic Models for Some Intelligence and Attainment Tests*. Danmarks Paedagogiske Institut, Copenhagen, Denmark.
- Rawls, J., 1971. *A Theory of Justice*. Harvard University Press, New York City, NY.
- Ribot, J., Peluso, N.L., 2003. A theory of access. *Rural Sociol.* 68 (2), 153–181.
- Sadaf, S., Muhammad, S., Lodhi, T., 2005. Need for agricultural extension services for rural women in Tehsil Faisalabad, Pakistan. *J. Agric. Soc. Sci.* 1 (3), 248–251.
- Salas, E., Tannenbaum, S.I., Kraiger, K., Smith-Jentsch, K.A., 2012. The science of training and development in organizations: what matters in practice. *Psychol. Sci. Publ. Interest* 13 (2), 74–101.
- Sanya, B.N., 2017. *States Of Discretion: Black Migrating Bodies and Citizenship in the United States*. (PhD). University of Illinois at Urbana-Champaign, Champaign, IL.
- SAWBO, 2020. *Postharvest Loss: Jerrycan Bean Storage [Lomwe]*. Retrieved 8 January, 2021, from. <https://sawbo-animations.org/490>.
- Shiffrin, R.M., Nobel, P.A., 1997. The art of model development and testing. *Behav. Res. Methods Instrum. Comput.* 29 (1), 6–14.
- Siebert, R., Toogood, M., Knierim, A., 2006. Factors affecting European farmers' participation in biodiversity policies. *Sociol. Rural.* 46 (4), 318–340.
- Stadler, W.A., Gottschalk, P., 2021. Testing convenience theory for white-collar crime: perceptions of potential offenders and non-offenders. *Deviant Behav.* 1–18.
- Sull, E.C., 2014. Student engagement, motivation, and rapport. *Dist. Learn.* 11 (3), 5–9.
- Taylor, P.J., 2010. *Unruly Complexity: Ecology, Interpretation, Engagement*. University of Chicago Press, Chicago, IL.
- Terui, S., Hsieh, E., 2016. Not homeless yet. I'm kind of couch surfing": finding identities for people at a homeless shelter. *Soc. Work. Publ. Health* 31 (7), 688–699.
- Thomas, M.D., Blacksmith, J., Reno, J., 2000. Utilizing insider-outsider research teams in qualitative research. *Qual. Health Res.* 10 (6), 819–828.
- Tiwari, R.K., 2018. Empowering women through agricultural extension: a global perspective. *Indian Rural Market: Oppo. Chall. Glob. Cont.* 1 (1), 68–75.
- Tochluk, S., 2010. *Witnessing Whiteness: the Need to Talk about Race and How to Do it*. Rowman & Littlefield, Lanham, MD.
- Tough, P., 2012. *How Children Succeed : Grit, Curiosity, and the Hidden Power of Character*. Mariner Books, Boston, MA.
- Umata, G., Lemecha, F., Mume, T., 2011. Survey on women access to agricultural extension services at selected districts of Mid Rift Valley of Ethiopia. *J. Agric. Ext. Rural Dev.* 3 (3), 51–63.
- United Nations, 2015. *Sustainable Development Goals*. Retrieved 27 March 2022, from. <http://www.un.org/sustainabledevelopment/>.
- USAID, 2017. *FACT SHEET: Collaborating, Learning and Adapting at USAID*. USAID, Washington, DC.
- Viets, A.L., 2009. *Same Gender Classrooms and Student Achievement*. Lindenwood University, St. Charles, MO (PhD).
- Vogel, I., 2012. Review of the Use of "Theory of Change" in International Development: Review Report. UK Department for International Development (DFID), London, UK.
- Waddington, M., Mohan, G., 2004. Failing forward: going beyond PRA and imposed forms of participation. In: Hickey, S., Mohan, G. (Eds.), *Participation: from Tyranny to Transformation: Exploring New Approaches to Participation in Development*. Zed, London, UK, pp. 219–234.
- Waldenfels, B., 2002. Levinas and the face of the other. In: Critchley, S., Bernasconi, R. (Eds.), *The Cambridge Companion to Levinas*. Cambridge University Press, Cambridge, UK, pp. 63–81.
- Wenger, E., 1998a. Communities of practice: learning as a social system. *Syst. Thinker* 9 (5), 1–10.
- Wenger, E., 1998b. *Communities of Practice: Learning, Meaning, and Identity*. Cambridge University Press, New York City, NY.
- Wetzel, E., Böhnke, J.R., Brown, A., 2016. Response biases. In: Leong, F.T.L., Iliescu, D. (Eds.), *The ITC International Handbook of Testing and Assessment*. Oxford University Press, New York City, NY, pp. 349–363.
- Wu, J., Konrad, J., Ishwar, P., 2014. The value of multiple viewpoints in gesture-based user authentication. In: Paper Presented at the Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition Workshops, Columbus, Ohio.
- Yale, L., Venkatesh, A., 1986. Toward the construct of convenience in consumer research. In: Lutz, R.J. (Ed.), *North American Advances in Consumer Research*, 13. Association for Consumer Research, Provo, UT, pp. 403–408.
- Yasir, A., Ahmed, A., Anum, L., 2021. Corporate financial crimes in Pakistan—a review and analysis. *J. Financ. Crime*.
- Yoder, L., Ward, A.S., Dalrymple, K., Spak, S., Lave, R., 2019. An analysis of conservation practice adoption studies in agricultural human-natural systems. *J. Environ. Manag.* 236, 490–498.
- Zalanga, S., 2018. The political economy of corruption. In: Oloruntoba, S., Falola, T. (Eds.), *The Palgrave Handbook of African Politics, Governance and Development*. Palgrave Macmillan, New York City, NY, pp. 869–882.
- Zeid, A., El-Bahey, R., 2011. Impact of introducing single-gender classrooms in higher education on student achievement levels: a case study in software engineering courses in the GCC region. In: Paper Presented at the 2011 Frontiers in Education Conference (FIE).
- Zheng, W., Yu, F., Wu, Y.J., 2021. Social media on Blended Learning: the Effect of Rapport and Motivation. *Behaviour & Information Technology*, pp. 1–11.