

How Deliberative Designs Empower Citizens' Voices:

A Case Study on Ghana's Deliberative Poll on Agriculture and The Environment

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Abstract. Empowering ordinary citizens with the capacity to deliberate is a core issue in science communication. Despite growing deliberative practices in developed nations, it is significantly less understood how public deliberation can happen among populations who live with limited educational resources and poor urban infrastructure in developing countries. This paper studied a case of a well-designed deliberation method, Deliberative Poll, in Tamale, Ghana. I analyzed the stimulus information video and thousands of speech acts from deliberation transcripts, to examine how scientific expertise was used, and what was deliberated in public dialogue. A broad range of scientific expertise and interests were represented. Participants had thoughtful discussions on complex policy issues and their discussion results were considered by local policymakers. This paper contributes to our understanding of how to effectively foster public deliberation among populations in the Global South and measure the nuances of scientific expertise and public reasoning on science.

Introduction

Empowering ordinary citizens with the capacity to deliberate is central for collectively tackling complex policy issues such as environmental sustainability and controversial technologies (Boulianne et al., 2020; Dryzek et al., 2019; Ostrom, 1990; Rhodes and Sawyer, 2015; The National Academies of Sciences Engineering Medicine, 2017). Scholars have long debated whether ordinary citizens have the capacity to reason about science (Sturgis and Allum, 2004; Posner, 2005:107; Rosenberg, 2014; Cortassa, 2016). Growing evidence debunks the knowledge deficit model (Akin and Scheufele, 2017; Hart and Nisbet, 2012; Nyhan and Reifler, 2015). Instead of simply instilling the public with scientific facts, deliberative processes have been suggested as a way to address 'wicked problems' (Brossard and Lewenstein, 2009; Jamieson et al., 2017; Jasanoff et al., 2015; Moore, 2018). These deliberation practices can be held in an offline space such as consensus conferences or in public forums across social media. Despite agreement on a deliberative approach to improve public understanding of science, evidence – especially investigation into what public engagement designs are effective to improve public dialogues – is still limited. As Bächtiger (2018:657–662) noted, to date, we lack empirical investigation regarding how ordinary citizens can deliberate complex policy issues and under what condition(s). Moreover, although addressing highly complex issues requires global effort, the majority of deliberative practices occur in developed nations. It is significantly less understood how to effectively engage populations in the Global South where many still lack formal education and socioeconomic resources and are afflicted by existing policies.

This paper fills these gaps by examining the pressing question of how deliberation designs can aid ordinary citizens with limited education and poor living conditions in the Global South to engage in thoughtful discussions on complex issues. This paper examined a Deliberative Poll that was conducted in Tamale, Ghana in 2015 on agriculture, environment, and public health challenges. I investigated the design and effects of this Deliberative Poll in three ways. First, I studied what kind of scientific expertise was included in the information material provided to participants and how public deliberation dealt with scientific expertise. Secondly, I examined the organization of small group discussions and how these organizations affected the quality of deliberation. Finally, I examined the effects of people's deliberation on policymaking. This paper contributes to scholarship in public deliberation and science communication by explaining how communities with poor educational and urban infrastructure can engage in a deliberative process, the richness of their engagement, and the design that facilitates this process.

2. Public Deliberation and Science Communication

Deliberation on Complex Policy Issues

Deliberation is a form of communication with certain characteristics that facilitate public will. The core of deliberative democracy is reason-giving (Gutmann and Thompson, 2004:3), which requires people to use reasoning (including facts, storytelling, moral appeals) when they express opinions and respond to others' arguments. Scholars have noted that public deliberation is crucial for science communication, especially in a post-normal science age where many policy issues are highly complex. Funtowicz and Ravetz (1993) defined complexity thus: "facts are uncertain, values in dispute, stakes high, and decisions urgent" (744). Because of social contexts connected with post-normal science, Funtowicz and Ravetz (ibid.) advocated for the need to involve "extended peer communities" as an active part in the solution for these problems. These extended peer communities are those affected by the policy and can provide "extended facts" ranging from "housewives' epidemiology" to investigative journalism (Ravetz, 1999, p. 651). Rittel and Webber (1973) coined these complex science policies as 'wicked problems', problems with no clear solution, which are not tame nor benign. They explained wicked problems as "have neither of these clarifying traits; and they include nearly all public policy issues—whether the question concerns the location of a freeway, the adjustment of a tax rate, the modification of school curricula, or the confrontation of crime" (160). Examples of deliberation about 'wicked problems' include biobanking in British Columbia (Walmsley, 2010), the U.S. National Citizens' Technology Forum (Anderson, Delborne, et al., 2013), public deliberation on genetically modified maize in southern Africa (Mwale, 2006), a consensus conference on GMO foods in Taiwan (Fan, 2015), and deliberative public engagement events among Canadians on cancer drugs (Bentley et al., 2019).

Skepticism on People's Capacity to Deliberate

Despite flourishing deliberation events, some doubt people's capacity to deliberate. Because deliberation requires a strong reasoning capacity, many skeptics contend that only elites and scientists – not ordinary citizens – can deliberate, not to mention marginalized populations. This skepticism of the public's cognitive capacity reappears in public understandings of complex topics such as science (Ahteensuu, 2012; Cortassa, 2016; Nisbet, 2018, sec. I). Some evidence shows that

ordinary citizens, even in advanced nations, cannot deliberate policy issues (Jacobs et al., 2009; Posner, 2005; Rosenberg, 2007, 2014), suggesting that information deficit and cognitive bias hinder public understanding of science. In developing countries where many populations still lack formal education resources, the application of deliberative democracy on science is further impeded (Humphreys et al., 2006). Although international organizations such as the World Bank have promoted participatory approaches to governance in developing countries, the practice of deliberation suffers severe problems: it is undermined by bureaucrats/politicians/vested interests from clients (Gibson and Woolcock, 2008; Lancaster et al., 2003; Murphy, 1990; Sheely, 2015) and there are a variety of power dynamics that could undermine people's voices during the participatory discourse (Cooke & Kothari, 2001).

The Value of Public Deliberation to Science Communication

In spite of this skepticism, some scholars challenge this cognitive deficit model by identifying that the public can provide valuable, useful knowledge for science (Dietz, 2013). Scholars have noted that policymaking requires various forms of knowledge, including knowledge from lay citizens based on their practical experience, folk wisdom, or indigenous culture (Peters, 2008, Chapter 9). This body of scholarship highlights a participatory model of science communication (Sapp et al., 2013). Schibeci and Barns (1998) argued that there is a research challenge to create engaged and dialogical communication modes in science and technological discussions that account for the life experiences of lay people's experiences. Peters (2008:135–136) observed that contextualized knowledge, social values, and interest must be integrated into the scientific knowledge generation process. For populations in developing countries, Awa (1989) stressed that indigenous knowledge is crucial to promote intervention programs on development. Instead of a donor/government dominant approach for deciding what is in the public's interest, people should be incorporated into these conversations to foster their capability to build autonomous wellbeing (Sen, 1993). In line with these authors, this paper defines scientific expertise more broadly, integrating different types of knowledge.

Contributions of Paper

Despite emphasis on the value of lay knowledge, there is a lack of studies on how populations with poor living and educational resources can engage in science communication. These populations exist in both developing and developed countries. There is emerging anecdotal evidence that populations with poor development resources can possibly raise thoughtful opinions on complex policy issues, for example in Ghana town hall meetings (Paller, 2016), South Indian villages (Rao and Sanyal, 2010), and Brazil participatory institutions (Donaghy, 2011; Wampler, 2010). Despite this, Bächtiger (2018:660) noted that there are very few empirical studies studying deliberative quality due to the lack of advanced and big data tools to investigate the dynamics of deliberation. Therefore, there remains thin empirical literature on democratic deepening in the developing world (Heller et al., 2007). Further, research rarely goes beyond anecdotal evidence to systematically analyze public discourse itself to understand how people in developing nations deliberate about complex policy issues. Even fewer studies explore the conditions that can make deliberation possible for populations under such a challenging environment. In response, this paper studies how effective deliberative designs can empower these populations to raise thoughtful arguments and facilitate the use of various types of knowledge.

This paper contributes to the literature on the public engagement of science (Brossard and Lewenstein, 2009; Nisbet, 2018; Nisbet and Markowitz, 2015) by introducing a specific deliberative design that helps marginalized populations form thoughtful opinions. Since the rise of the public engagement approach, various deliberative practices have been implemented to engage the public in environmental discussions (Blok, 2007; Walker, 2007). Yet, a key challenge is the representativeness of the participants. In many examples, participants are professionals with substantial expertise (Langbein, 2005) or a self-selected group of citizens who are more interested in environmental topics such as those who participate in consensus conferences. From this relatively homogenous sample it is hard to know whether the resulting opinions are representative of the whole population. Therefore, it is crucial to ensure that diverse types of expertise are included during deliberation. As Dietz (2013) stressed, “individual and social values” (p.1909) of the lay public are crucial for environmental policy, as is a deliberative design that can combine scientific expertise with these values.

3. Effective Deliberative Democracy Design

So, what makes for an effective deliberative democracy design? (Himmelroos, 2017:2) identified that a high-quality deliberation includes “claims supported by well-defined justifications; concern for the common good; respect for others; and a willingness to consider alternative views.” Smith (2009, Chapter 3) further specified the elements of an effective deliberative mini-publics design, including a representative sample, randomly selected to ensure inclusiveness, facilitated small groups with procedural values and rules set, and considered judgment (ensured by participants hearing evidence from a range of people; discussing issues with other citizens with a diversity of social perspectives; orientating citizens toward considerations of the public interest). Fishkin (2018:200–201) raised four criteria to evaluate a deliberative system: “Are the deliberations placed in the system so that they are inclusive? Is there a choice of significantly different alternatives? Can the people effectively deliberate about the reasons for and against the options in a context of good information? Do the deliberations have impact?”

The case I study here uses the Deliberative Poll (DP)¹ design, a scientific method of public consultation that exposes participants to a balanced, diverse, and equal information environment. In every DP, participants are selected by random sampling of the whole population to ensure representativeness. Participants are given well-balanced information material before the deliberation event to read about the issues to be discussed. The information material introduces the background of the topic(s) and lists the pros and cons of each proposal. The information material is prepared by an extensive advisory committee consisting of academic experts, NGOs, stakeholders, and government officials. To tailor information material to marginalized populations in the Global South, in the past, videos have been provided in DPs held in African countries (Malawi, Ghana, Senegal, Uganda) because many participants were illiterate.

On the deliberation day(s), participants are randomly assigned to small groups of 10-15 people. The discussion is moderated by a well-trained moderator that ensures everyone can express their opinions without a dominating voice. For instance, during facilitation moderators stress things like “*in this discussion, no opinion is wrong. Everything you say is important and must be taken into consideration;*” “*is like everybody is talking about the good aspect of this proposal. Can we get opposing ideas?*” These small groups are convened in a plenary session where they ask questions

to a panel of scholars and policymakers in the area of discussed issues. Therefore, DPs integrate different types of knowledge as expertise. Scientific knowledge from scholars is sufficient to inform participants but does not dominate the deliberation's outcome (Moore, 2018). The moderated small group discussion also helps foster deliberative communication that is based on weighing the merits of different arguments.

Deliberative Polls are different from the consensus conference, a common practice in science communication. In a consensus conference, participants need to reach a consensus while DP participants do not, which avoids potential problems such as group polarization. DPs are also larger in scale (100-200 people) than a consensus conference, which ensures more public participation and better statistical representatives of participants.

4. Case Study: Deliberative Poll in Tamale, Ghana

Data

This paper focuses on a case study of a DP conducted in Tamale, Ghana on January 10th and 11th in 2015. Ghana ranks the lowest 25% on the Human Development Index by UNDP²: its mean year of schooling is 7 years (in the U.S. it is 13.4 years); its gross national income per capita is \$4,096 (in the U.S. it is \$54,941). The level of education and socioeconomic conditions in Tamale is even lower than the general population of Ghana (Abdulai and Hickey, 2016). Tamale lies in the Northern Region of Ghana with a population of 360,579 in 2010, thus one of Ghana's most populous cities. Its residents face challenges in the interconnected sectors of public health, environment, and agriculture. For instance, a majority of its toilets are located in and near farming sites.

In the Tamale DP, 208 participants were selected using a random selection of households in the metropolitan area. These participants are representative of the general population in both demography and attitudes toward city policies: 48% male, an average age of 33.7, 27.9% never been to school, and only 3.9% were first degree holders (see Appendix Table A and B in Chirawurah et al., 2019). They attended a 2-day deliberation. Considering that one-third of the participants were illiterate, written briefing material was replaced by videos to introduce the issues. Topics discussed in the Tamale DP are Water, Sanitation, and Hygiene (WASH) and Livelihood and Food Security³. These proposals require weighing the trade-off between different values. For instance, one proposal asks participants to rate to what extent they agreed with two competing statements: “vegetable farms should produce as much as possible, even if they must use the wastewater from toilets” and “vegetables should only be produced with clean water, even if that means fewer vegetables are produced.” Participants needed to consider a trade-off between food sufficiency and public health as each option has risks, spreading diseases through wastewater or reducing food production, which can result in hunger.

Method

This paper leverages three types of data with corresponding methods described below to study the design and effects of this Deliberative Poll. First, I examined how expertise was presented in the Tamale DP by analyzing who the speakers were from the 21-minute stimulus video that was shown

to participants before deliberation and what core messages these speakers raised⁴. This video was prepared by eleven people on the Tamale DP advisory committee. The committee members come from NGOs such as West Africa RILab, academic institutions in Ghana and the U.S., and the Tamale Metropolitan Assembly (see Appendix G in Chirawurah et al., 2019). Results on the use of scientific expertise are presented in Section 5.

Second, I discuss changes in public opinion from the results provided in Chirawurah et al. (2019) that compared public opinions between pre and post deliberation questionnaires. Participants were given two standardized questionnaires, one before and one after the deliberation event. Questions that asked participants to rate each proposal were the same in both surveys to allow comparison. Participants were asked to rate each proposal on a scale from 0 to 10, where 0 means that a participant thinks this proposal is extremely unimportant and 10 means the proposal is rated extremely important. T-tests were performed to compute the direction, size and statistical significance of public opinion changes. Results on opinion changes are discussed in Section 6.

Third, I examined the nature and quality of deliberation through manual and automated content analysis on all the deliberation transcripts. To examine how participants engaged in thoughtful deliberations, I studied all the speech acts participants made in the 15 small group discussions across the two days. A speech act is defined as “the public discourse by a particular individual delivered at a particular point in a debate” (Steenbergen et al., 2003, p. 27). The small group discussion transcripts are organized by participant pseudonyms. Each speech act is operationalized as anything uttered by a participant until the next participant speaks. (see Supplemental Material I for a screenshot of this operationalization). A total of 3,083⁵ speech acts in the deliberation session made by participants were analyzed. Two randomly chosen small groups’ discussions were hand-coded (N=422). Then automated text analysis, a method for using computer programming to perform content analysis on text data, was used to code the remaining speech acts (for details, see Supplemental Material II)⁶. Each speech act was coded along four variables: *related to the proposal* or not, *type of speech acts*, and *level of reasoning in terms of opinions and responses* (Table 1).

Table 1
Coding Scheme for Deliberative Reasoning and Examples

Coding Variable	Definition and Attributes
Related to the Proposal	Is the speech act related/relevant to the proposal? (1, 0)
Type of Speech Acts	Opinion Inquiry Response to opinion/inquiry
Opinion – Level of Justification	No justification at all (e.g.: “Loans are not very important but what is important for us to desist on the interest on the loans.”) Justification with reasoning (e.g.: “Back yard farming is very important to us because we can sometimes sell some of the farm produce to satisfy our needs and to take care of our children.”)
Response - Level of Reasoning	Simple (e.g., “Yes my brother you are right.”)

	Substantive (e.g., “Just like my father is saying, it is true that the assembly should be able to monitor us and see whether we are doing the right thing. Sometimes they bring lines and rules which some of us follows whiles others refuse to follow it. So I think the monitoring is important.”)
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For the variable *types of speech acts*, based on the nature of the speech acts in the Tamale DP, each speech act was categorized into three types: an opinion about the proposal, an inquiry for information, and a response to others’ opinions or inquiries. These three speech types capture the *content* of the speech acts and are mutually exclusive.

To measure the *level of reasoning* of a speech act, I drew upon the latest Discourse Quality Index (DQI) and enhanced the DQI by proposing an indicator to measure “communicative reasoning” (for details, see Supplemental Material III). DQI provides different variables for scholars to perform content analysis on discourses such as whether people use justification and refer to common good in their speeches. In the DQI, the authors measured reasoning using “level of justification” – to what extent one uses reasoning when expressing opinions (Steiner, 2012, Appendix). The DQI has been widely used to measure parliamentary debates and citizen deliberation across the globe (Steiner, 2012; Steiner et al., 2004). Level of justification in this paper considers a variety of communication styles: citing facts, testimonies/storytelling, raising assumptions for proposals to work, and raising suggestions for the proposal to work (see Supplemental Material V for examples). Results on the richness of public deliberation are presented in Section 7.

Several rounds of inter-coder reliability checks were conducted to ensure that coding rules were clear. A standard reliability measure, Krippendorff’s alpha (Hayes and Krippendorff, 2007), was used to check inter-coder agreement of each variable (i.e., *relevant to the proposal, type of speech act, opinion-level of justification, response-level of reasoning*). On average, the inter-coder reliability of the manual coding is 0.9, indicating a high agreement among coders (Supplemental Material IV).

5. Expertise in the Tamale Deliberative Poll

Selection of Expert Sources, Issues, and Frames in the Information Video

In this part, I summarize who the information video’s speakers were and what knowledge they brought to the deliberation topics. The information video starts by flagging the rapid population growth (a graph was shown) in Tamale, which put stress on water, sanitation, and everything related to food and health. The first section of the video is about the Livelihood & Food Security issue. Speakers in this section consisted of a presiding member of the Tamale Metropolitan Assembly (TAMA), a lecturer from the University of Development Studies, a housewife who practices backyard farming, a nurse at the Tamale Teaching Hospital, and a trader at the Aboabo Market. These speakers are politicians, professors, and ordinary citizens affected by the food security issue. The core messages they raise are 1) Tamale has very little land for farming and thus backyard framing should be encouraged and 2) there is a great need to empower women with knowledge of nutrition for children. Next, one highlighted proposal came from a nurse at the Tamale Teaching hospital; she suggested providing mothers with the financial resources and

education to identify balanced meals. Additional proposals were then mentioned briefly including microcredit institutions, village saving loans to support members, and training to set up backyard poultry farming.

In the “Sanitation and Hygiene” section of the video, speakers included a presiding member of TAMA, a secretary at the Aboabo Market Foodstuff Sellers Assembly, a toilet attendant, a landlady, a sanitation chairman, a housewife, and a water treatment attendant. These speakers are those affected by poor sanitation or who managed the local toilet facilities, the community leaders who oversee the issue, and a professor who studies sanitation. The core messages raised by these speakers are 1) current management of toilets is very poor and 2) we should use environmentally clean methods to treat waste. In the next part of the video, additional proposals were also read briefly: set up sewage treatment plants; promote segregation of household wastes; promote the sorting of waste, promote the use of environmental-friendly toilets in all places; ban the use of untreated waste.

In the “Water” section of the video, speakers consisted of a water seller, a car wash operator, a resident in Gumani, a staff member working at an NGO on water issues, and a technical advisor on water management. The two core messages raised by these speakers are 1) existing water management methods such as selling water or drilling boreholes are not helpful and 2) we need innovative practices such as water recycling or building rainwater harvest tank to address water shortage.

At the end of the video, arguments in support and against some proposals were summarized by the video narrator. Arguments supporting these proposals are summarized as: reduce diseases; improve health and longevity; promote a clean environment; lower cost of healthcare. Arguments opposing these proposals are summarized as: require additional energy resources; people might not like plants beside houses; we need a change in attitudes and behavior in improving sanitation.

Table 2 presents the details of the speakers and summaries of their arguments. In terms of what scientific expertise was used in the video, I found that these speakers represented people possessing various types of knowledge: policymakers, scholars, and lay citizens who are differently affected by these issues. Because of their diversity, their arguments provided a variety of expertise: more technical-related knowledge from policymakers and scholars and local knowledge from lay citizens such as cultural values, habits and practical experiences. For instance, scientists who study innovative practices of water treatment were invited to share their findings in the video. At the same time, ordinary citizens such as a car wash operator was also invited to provide domain knowledge regarding how they efficiently recycle water, use water tanks, and practice small farming.

Table 2

Speakers and Core Messages in the Information Video

Issues	Speakers in the video	Core messages
	Presiding member, TAMA	There is very little land for farming.
	Housewife	Backyard farming is necessary.

Livelihood & Food Security	Lecturer at the University of Development Studies	Nutrition matters for everyone's health.
	Nurse, Tamale Teaching Hospital	Current diet to feed children lacks nutrition.
	Trader, Aboabo Market	Sales affect whether children can have protein-rich cereals.
	Nurse, Tamale Teaching Hospital	We can provide mothers with financial resources and education to learn about balanced meals
Sanitation & Hygiene	Presiding member, TAMA	It takes too long for the assembly to dispose waste.
	Secretary, Aboabo Market Foodstuff Sellers Assembly	There is only one waste container for the whole market.
	Toilet attendant	We charge people to use toilet and I maintain it clean.
	Male resident, landlady	We do not have a toilet at home and assembly never built a toilet for the community.
	Sanitation chairman	Feces in dam pose threat to health.
	Housewife	The water I fetched from the dam is severely polluted.
	Water treatment attendant	Much treatment is needed to make water drinkable.
	Regional environment health officer	Assembly should take action on waste dumping.
	Northern regional minister	Cholera and Ebola are related to sanitation.
	Professor at the University for Development Studies	Our projects train people how to use organic products and turn waste into organic compose.
Water	Water seller	I do small farming and need to sell water to pay for child's school.
	Car wash operator	I use innovative practices to recycle water.
	Resident	We clean the tank to ensure clean water.
	A staff member at the Creating Change Organization Country	We suggest building sustainable rainwater harvest tanks which is sustainable throughout the year.
	Technical advisor	We use environmental-friendly chemicals to treat water for drinking and irrigation.

6. Pre- and Post-Survey Results

Examining the pre and post survey results from (Chirawurah et al., 2019), participants were found to have significant and substantial opinion-changes after two days' deliberation. In fact, the majority of policy proposals showed significant changes at the 0.01 level (see Supplemental

Material VI). For instance, for the proposal that requires participants to weigh the trade-off between environmental-friendly farming and food sufficiency (proposal 40), participants' attitude on the importance of farming with clean water increased from 9.0 to 9.5 on a 0-10 scale ($p < 0.01$)⁷. This indicates that although participants knew that farming with clean water might run the risks of food shortage due to limited clean water supply, improving environmental-friendly farming might help them fight public health issues in the long-run. In fact, proposals rated highest after deliberation are those related to public health such as the proposal to "promote public education for effective cholera control" (proposal 39) and "promote the use of environmentally-friendly toilets in all houses" (proposal 23). This attitude on developing environmental-friendly agriculture is also shown in opinion changes across other proposals such as people's increased support for proposal to "promote the use of carrier bags made of biodegradable material" (8.1- \rightarrow 8.9, $p < 0.01$) and "ban the use of plastic carrier bags in the city" (6.8- \rightarrow 7.6, $p < 0.01$). Among the proposals that showed no significant opinion changes are those related to loans and savings association (proposal 4) and weather forecasting information (proposal 7).

7. How Deliberative Discussions Occur

Not only did participants change their opinions, their opinion changes were also grounded in thoughtful reasoning and engagement with their peers. In this section, I examined what arguments were raised and how people deliberated.

Richness of discussions: what arguments people raised

To study how participants responded to the expertise in the information video and what additional arguments they put forward as a result of deliberation, I examined their speech acts that utilized reasoning, and the arguments people presented during the small group deliberation. Existing scholarship has shown that aspects primed by science communication are particularly influential in forming opinions (Anderson, Kim, et al., 2013). My findings from the deliberation transcripts partially confirm this (Supplemental Material VII). Take group 11's discussion on Livelihood & Food Security, for example. I found that participants agreed with the speakers in the videos that backyard farming is good. However, they also raised a prerequisite for the proposal to work well: city officials must provide education and training on how to practice backyard farming. For the proposal of empowering mothers with financial resources, participants were concerned that the proposal of providing loans might be too naïve. For instance, some participants pointed out that people might run away with loans rather than paying it back on time. Due to this concern, some participants raised a new proposal of establishing local saving centers ("susu") to help people develop the habit of saving money because susu is a place where people deposit their own money rather than taking out loans.

Richness of discussions: how people reasoned about complex issues

In the Tamale deliberation, among all the hand-coded speech acts about *opinion* expression, only 9.7% speech acts used no reasoning (Table 3). For instance, when participants evaluated the trade-off between abandoning gardening with wastewater and running the risk of food shortage, some supported the ban by pointing out that "*banning it will be good. That is the main cause of cholera outbreak. You see many people farming around big gutters to make it easier for them to water*

their vegetables...” while others disagreed by pointing out that *“they should not ban it because we eat such vegetables always and nothing happens to use it does not affect us in any way. I have seen several people watering their vegetables with toilet water and it benefit the farmers a lot and benefit consumers too because they sell at cheaper price...”* Some participants even tried to reconcile the reasons their peers argued for or against the ban.

Table 3

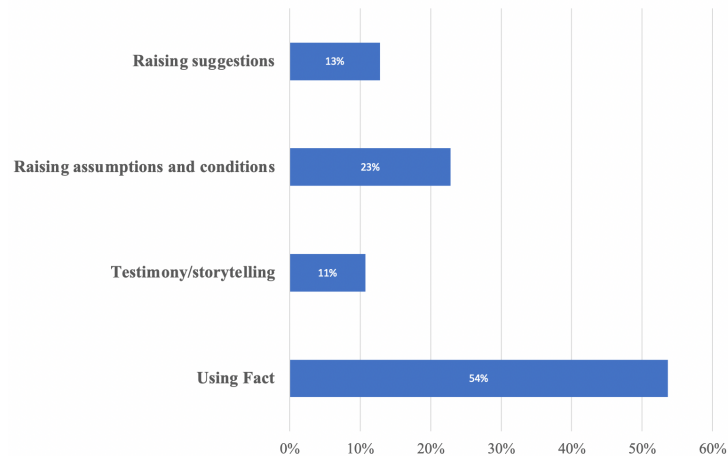
Tamale DP - Level of Reasoning in Opinions and Responses

Opinions (n= 320, 75.8% from all the hand labelled speech acts)	No reasoning	9.7%
	Use reasoning	90.3%
Responses (n=38, 9.0% from all the hand-labelled speech acts)	Simple response	2.6%
	Substantive response	97.4%

Further examining those speech acts that are about opinion expression and used reasoning (n=289), I found that many Tamale participants used sophisticated reasoning such as raising assumptions, conditions and suggestions to modify the current proposals (Figure 1). These types of reasoning accounted for 35.6% of their total number of opinions that used reasoning. For instance, on the proposal of whether the assembly should “promote training for households and community groups to set up backyard poultry farms,” one participant’s opinion is: *“if we get agric extension officers to guide us keep this animals, we can get the full benefit of keeping animals. But if they don’t come to guide us on how to keep these animals, I don’t think any benefit can be obtained...”* This participant raised “guidance” as an important condition to make backyard poultry farming effective. Therefore, drawing from the level of justification in the standard DQI to measure reasoning in deliberation, I found that the Tamale participants exerted a very high level of reasoning when they expressed their opinions.

Figure 1

Tamale DP: Types of Justification Used (n=289)



The essence of deliberation is more than using reasoning to express opinions, but about responding to others' arguments with justifications. Among all the speech acts categorized as *responses* to opinions/inquiries, I found that the percentage of substantive responses in the Tamale deliberation was 97.4% (Table 3). This indicates that when Tamale participants responded to others' arguments, they tended to apply reasoning to provide thoughtful interaction. For instance, one proposal suggested giving more information through media houses to educate people about sanitation. A female participant agreed, saying *"I agree to it because poor sanitation leads to a lot of diseases. If there is an opportunity for us to educate people on sanitation it will help prevent diseases because some people do not even think of bathing every day."* However, another participant disagreed, *"I want to comment on what one of the ladies said. I disagree with education on radio. They should rather pay attention on strengthening the work of the sanitary officers. When someone is penalized for not keeping the surrounding clean, the neighbours will be deterred from doing same."* Contributing substantive response is crucial for deliberation because it is an exercise for weighing competing arguments and requires people to listen and respond to each other thoughtfully. These reflective responses might not always lead to opinion changes, but discussions grounded by reasoning helps nurture people's capacity for deliberating about complex issues.

8. Effects of Deliberation on Policy

I also examined the outcome of deliberation on policymaking to understand to what extent policymakers in TAMA planned to incorporate people's deliberation results. Although I could not access policy documents from the Assembly, I utilized secondary sources to study the policy impact of deliberation. I first borrowed interview excerpts from Chirawurah et al. (2019). The first quote is from the Presiding Member of TAMA: *"... What has emerged from the DP is indicative of what the people of Tamale are concerned about thoughtfully. I will work with the Metro Assembly to implement key priorities such as those on water harvesting and sanitation and hygiene for basic schools."* (Hon. Mohammed M. M. Andani: Immediate past Presiding Member, TAMA & Member of Advisory Committee). This past presiding member highly regarded people's voices from the Tamale DP and planned to work with the metro assembly to implement key priorities raised in the deliberation such as water harvesting for schools. The second excerpt is from the new Presiding Member after the election: *"I am convinced that the issues of sanitation, water, hygiene and food insecurity as captured in the findings report reflects the generality of the challenges and*

aspirations for actions of our people. We cannot ignore these, something has to be done ... Once we make provision in our annual operational plans, it will be possible to set funds aside to work on sanitation, water, and food insecurity aspects.” (Hon. Abubakari Adam: Presiding Member, TAMA). Echoing the former leader, he also stressed that he will likely set funds aside for sanitation, water, and food insecurity, which were discussed during the deliberation. These two excerpts suggest that the key leadership in the Tamale Assembly were considering deliberative opinions. Future research can follow up with policymakers to investigate to what extent the proposals suggested by citizens were implemented. Further, local media covered the deliberative results of the Tamale DP. For instance, GhanaWeb, the third-ranking top site in Ghana⁸, published several articles to appraise Tamale Deliberative Poll as useful to identify solutions for the communities⁹.

9. Implications

In this paper, I demonstrated how effective deliberative design helps populations that lack higher education and live in poor neighborhoods to raise thoughtful public knowledge to address complex local problems and to influence policymaking. In an effective deliberative design, it is particularly important to include a broad range of expertise, especially for cultural settings like Ghana where there is a much more horizontal distribution of expertise. Expertise consists of various types of knowledge from scientists, lay citizens, and policymakers. Public deliberation complements what scientists and policymakers do not discuss. There are three major implications of our findings for science communication and public deliberation.

The first implication is the value of consulting local knowledge to address complex policy problems. As advocated by many scholars, addressing complex policies needs community input. However, little is understood regarding what values communities can bring and how to empower communities to offer thoughtful knowledge. This paper examined what arguments were put forward by the community in the Tamale DP and observed that participants raised prerequisites for existing proposals to work such as providing citizens concrete guidance and education programs and utilizing the community financial saving system. Therefore, when deciding which proposals to choose, participants weighed the economic and environmental values suggested by experts and raised the values of education and good financial management habits. These thoughtful arguments were facilitated by effective deliberative designs, i.e., moderated small group discussions, which helped to enlighten public knowledge. Participants not only raised valuable arguments but also backed their arguments with reasoning when expressing opinions and responding to others. Preliminary evidence reported in section 8 suggested that citizens’ insights and suggestions voiced in the Tamale DP were actually considered by policymakers. Scholars studying Ghana politics showed that local leaders cared a lot about having dialogues with citizens because social engagement can help them gain support and build political capital (Paller, 2019a:225–227, 2019b).

Secondly, effective design can empower populations with limited educational and living resources to participate in local affairs. Since the launch of the Comprehensive Development Framework, international organizations such as the United Nations and World Bank advocate for developing nations to achieve “well-being freedom” (Sen, 1993), it is crucial to empower ordinary citizens with the opportunity to decide their own development (Deneulin, 2006; Dreze et al., 1999; Sen,

1990, 1993, 1999). In this paper, I show the viability of deliberation with a random population sample to provide thoughtful inputs into public policymaking in developing countries. Instead of just letting experts or stakeholders make decisions on complex issues, the Ghana DP shows that it is possible to consult the people themselves in a representative and thoughtful way. Although this paper focuses on populations in a developing country, these design lessons can also be applied to populations in developed countries who lack educational and living resources. Notably, when designing an effective deliberation for these populations, practitioners need to tailor the design in several manners. In the Tamale DP, which differed from many deliberative polls where the information material is in a written format, participants watched a video because almost 30% of the participants were illiterate. Moreover, to offer diverse perspectives to the participants about the proposals and make the video more citizen-oriented, many speakers in the video are neighbors/grandmas on the streets familiar to participants, not just scientists and experts. During the small-group discussions, moderators practiced conversational style of the locality by calling participants brothers/sisters instead of their names.

Finally, this paper enriches our understanding of science communication and public deliberation in at least two ways. First, it responds to works questioning ordinary citizens' capacity to engage in thoughtful deliberation. I provided detailed insights into the nature of deliberation among populations who have limited educational and living resources, including how scientific expertise is used and what kind of arguments the population produced. This empirical evidence speaks to the importance of reflecting upon what scientific knowledge means in a complex policymaking context: not only expert knowledge, but also layperson knowledge based on thoughtful deliberation. Secondly, this paper responds to the increasing call for listening to people's voices in policymaking. Specifically, little is understood on how deliberation can occur and how effective designs can aid thoughtful engagement among communities who have limited education and live in poor neighborhoods. In response, this paper demonstrates how deliberation can aid in listening to citizens' voices for deepening democracy and participatory accountability to improve public wellbeing.

This study clearly shows that citizens can reason together, weigh competing arguments, and develop judgments about the policies that affect their daily lives.

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¹ For details of what Deliberative Poll is and its application over the past decades, see: <https://cdd.stanford.edu>

² For details of the index for all countries, see: <http://hdr.undp.org/en/composite/HDI>

³ For Tamale DP report, see: <http://cdd.stanford.edu/2015/a-report-on-the-first-deliberative-poll-in-tamale-ghana/>. Details of all the proposals are in Table 1.

⁴ Besides studying who the experts are from the information video, I also examined who the experts were that were invited to the plenary session at the Tamale DP. To do this, I examined the transcripts of the plenary session. Although names were removed from the transcripts, I was still able to speculate who the speakers were at the plenary session from moderators' reference language. On day 1, the experts were a presiding member from TAMA and a Professor at the University for Development Studies. On day 2, the experts were a presiding member from TAMA, director for human relation of the university, and two professors.

⁵ This paper excluded speech acts that were not related to the deliberation session. For example: speech acts that are about the introduction of participants, logistic issues, and from the moderators.

⁶ Results reported in the table are based on manual coding. Details of automated coding and its results are in Supplemental Material II.

⁷ The statistics (including p value and effect size of opinion changes) in this paragraph were obtained from Appendix Table C in (Chirawurah et al., 2019). I rounded to one digit after the decimal point to conform to journal style.

⁸ <https://www.alexa.com/topsites/countries/GH>

⁹ <https://www.ghanaweb.com/GhanaHomePage/NewsArchive/Deliberative-polling-proves-useful-in-Tamale-391115>;

<https://www.ghanaweb.com/GhanaHomePage/NewsArchive/Successful-deliberative-polling-conducted-in-Tamale-387540>