Piloting Participatory Arts-Based Methods for Exploring Indonesians' Experiences in a U.S. Biotechnology Training Program

Science communication faculty and professionals often train scientists about conveying and delivering critical and sometimes controversial scientific information to public audiences (Besley & Tanner, 2011). This comes as governments, higher education institutions, and research funders increasingly expect scientists to participate in a variety of in-person and online communication activities (Trench & Miller, 2012). In the context of agricultural and natural resource sciences, there is a plethora of growing issues of public concern such as climate change, water quality, food security and safety – specifically, genetically modified organisms (GMOs) and biotechnology. Regarding GMOs, a Pew Research Center survey showed 39% of surveyed Americans (n = 1,480) "consider genetically modified foods worse for a person's health than other foods" (Funk & Kennedy, 2016; pg. 4). The International Food Information Council Foundation (IFIC) (2016) reported 26% of Americans have neither favorable nor unfavorable views of biotechnology and 25% do not know enough about it to form an opinion.

The expectation is growing for biotechnology scientists to explain their work via a variety of platforms, and it is imperative that science communicators develop effective training for increasing public science literacy about food (Gunter, Kinderlerer, & Beyleveld, 1999). One mechanism for training scientists about strategic communication is the lecture/direct instruction method to present common communication theories and models (Besley & Tanner, 2011). However, recent science communication training efforts from organizations such as the Alan Alda Center for Communicating Science have moved away from lecturing to incorporating engaging strategies such as improv workshops for scientists (Bartels, 2017). There is a lack of peer-reviewed published research focused on strategic and innovative efforts to develop communication training for scientists following experiential learning principles, hands-on, participatory, and project-based learning (PjBL) design for engagement. More intentional active learning approaches might have better results than lecturing, which is passive and leads to less memorable learning (Kolb, 2015; Buck Institute for Learning, 2016; Larmer & Mergendoller, 2015). One way to implement active and participatory learning into science communication workshops could be to introduce participants to communication theory via interactive discussion, followed by utilizing mobile devices for media training and participant engagement in PjBL for developing scientific interviewing and online multimedia production skills.

The authors of this study created science communication sessions as part of a United States Department of Agriculture (USDA) funded initiative to engage selected Indonesian agricultural fellows in visits to U.S. land grant universities to connect with American biotechnology scientists, field sites, and industry. Instead of taking a lecture-based approach, the authors piloted an active learning instructional approach and piloted participatory arts-based research methods using mobile devices for photography and video to examine the fellows' experiences and learning during the training, their perceptions of biotechnology and regulation, and views of science communication. The following qualitative case study describes arts-based methods used, as well as results from participant created photos and video interviews about their training experiences and biotechnology perspectives. The subsequent section outlines the study's grounding in literature related to international biotechnology, public science communication, and participatory arts-based research.

Literature Review

Addressing Agricultural Challenges through International Collaboration

Feeding the world's growing population is one of the most commonly cited challenges facing agricultural scientists and producers in the 21st century (Godfray, et al., 2010; Ingram, 2011; Rosegrant, & Cline, 2003). Pretty et al. (2011) pointed out that success is possible if policy makers, scientists, and producers across developed and developing countries work together to positively impact global food insecurity. Currently, the American Association for Agricultural Education's (AAAE) national research agenda outlines a need to increase public and policy makers' understanding of agriculture and the environment, and a need to develop a professional workforce for addressing large scale challenges (Roberts, Harder, & Brashears, 2016). The USDA (2017a), looking to address global food security challenges, identified the need to collaboratively train scientists in biotechnology for increasing scientists' knowledge and skills across continental divides.

Biotechnology is defined as the process of introducing new traits by insertion of specific DNA sequences to generate genetically modified organisms (GMOs) that express intended proteins or traits designed to reduce crop losses to pests with lower insecticide use, improved weed control by introducing herbicide tolerance, allowing application after plants emerge, and in some cases, maintaining yields during drought or other stress-related losses (Goodman, 2014).

Opponents of GMOs are concerned the modified foods may negatively impact human health or the environment (Funk & Kennedy, 2016). Contrastingly, many members of the scientific community view biotechnology as a safe means for addressing the world's need for increased food production (Funk & Kennedy, 2016). North America is often described as one of the leaders in biotechnology development and research (Pechlaner & Otero, 2008). Meanwhile, countries such as Indonesia have yet to adopt genetic modification (GM) (USDA, 2015). The U.S. exported agricultural goods including "soybeans, cotton, wheat, feeds and fodders, dairy, fresh fruit and beef, and beef products" totaling 2.6 billion dollars to Indonesia in 2016 (USDA, 2017b, pg. 1). Most of the soybean is GM, as well as maize, cotton and a substantial amount of canola. There are currently no approved GM wheat varieties. Much (>85%) of the GM crops are used for animal feed or industrial purposes), the rest for feed. According to the USDA Indonesian Agricultural Biotechnology Report (2015), no GM seeds were imported or planted in Indonesia. There are some food products made from GM plants, such as highly refined soybean oil. However, government and university scientists extensively researched biotechnology for "varieties including virus resistance for tomatoes and potatoes, delayed ripening for papaya, sweet potato pest resistance, and drought tolerant rice" (USDA, 2015, p. 2). While Indonesia pursues biotechnology, the country's policy makers remain cautious about GMOs and environmental, food, and feed safety and regulatory procedures (USDA, 2015).

Communicating Biotechnology Solutions to Public Audiences

Priest, Bonfadelli, & Rusanen (2003) described that it has been assumed that public adoption of biotechnology has progressed slowly due to a deficit of science understanding, lack of information, low education levels, and perceptions of risk. The researchers hypothesized that a public "trust gap" existed related to biotechnology adoption in the U.S. and Europe and found that political and cultural influences played a role in consumers' judgements about GMOs. Results showed consumers looked to institutions and "social actors" that were trustworthy and credible for making sense of public issues and did not solely rely on personal scientific knowledge. Scientists are frequently called to be the "social actor" to grow transparency in science, provide credible voices to the discussion, and increase public trust (Bik & Goldstein, 2013; Priest, Bonfadelli, & Rusanen, 2003).

The International Service for the Acquisition of Agri-biotech Applications (2014) reported that only 10% of university professors and public-sector scientists in Indonesia, Malaysia, and the Philippines have "attended a formal training in communicating science" and that most experts are "willing to engage more in science communication with proper training opportunities" (p.10). Hence, some current and upcoming scientists are preparing to take on public social roles by engaging in workshops and courses to practice communicating their research jargon, methods, and findings in non-scientific terms to lay audiences (Brownwell, Price, & Steinman, 2013).

Communicators and the media are repeatedly criticized for reporting only negative news and problems (Haagerup, 2015). The media is said to be influenced by biotechnology institutions and frames information about the topic via storylines focused on costs, benefits, trade-offs, dangers, ethics, and the environment (Priest, 1994). A survey of journalists ($n = 96$) showed that they overall "perceived university scientists/researchers as trustworthy, unbiased, and fair in communicating agricultural biotechnology issues" (Wingenbach & Rutherford, 2005, 215). Therefore, the opportunity appears to exist for biotechnology scientists to positively engage the public via traditional media and online platforms. A movement emerging in journalism sometimes referred to as solutions-journalism, constructive communication, or communication for social change taps into positive psychology and encourages communicators to take a solutions-focused approach to their storytelling (Gyldensted, 2015; Solutions, 2017). There is an opportunity to apply this same mindset for training scientists to communicate about biotechnology in terms of solutions.

Biotechnology Communication Training via a Mobile Participatory Arts-Based Approach

One approach to engaging biotechnology scientists in communication training could be to tap into experiential learning principles (Kolb, 2015) and project-based learning (Larmer & Mergendoller, 2015) to have scientists engage in hands-on activities to create multimedia products for practicing their biotechnology definitions and to demonstrate their learning. In the current Information Age, most citizens with access to the Internet and mobile devices are media consumers and media creators (Gillmor, 2010). Therefore, many people, including scientists, can utilize technologies and online platforms to communicate information with public audiences, without directly engaging journalists and the media to send out a message.

The Internet and mobile devices have increased access to reading and watching media and the ability to make multimedia (Farman, 2016). Billions of people around the world own smartphones and often shoot and upload content to social media sharing sites such as YouTube (Murphy, 2017). In Indonesia, mobile phone usage is more widespread than personal computer usage. There were nearly 282 million mobile phone subscriptions in 2012, and that number continues to rise (Puspitasari & Ishii, 2016). Smartphone and mobile tablet use for multimedia creation and information sharing has made it possible for anti-biotechnology and advocacy groups to easily and affordably add interactive content supporting their arguments online.

In the context of designing active learning mobile communication training for scientists, arts-based research (ABR) methods could be applied to examine effectiveness of the workshop, as well as scientists' experiences and perceptions. Art, whether writing, photography, painting, or mixed media is multidimensional and complex (McNiff, 2008). The creator makes choices about the subject matter and in what light to portray the subject, and the viewer re-interprets the art to form another layer of meaning (Haywood, 2010). Leavy (2008) described ABR as an emerging qualitative research paradigm stemming from the arts and psychology. Health professionals and therapists have used art as a way to engage participants in meaning-making and sharing of experiences (Knowles & Cole, 2008; Leavy, 2008). Barone and Eisner (2012) applied ABR to education research and described that ABR methods can give voice to participants and uncover their backgrounds, feelings, perspectives, and understanding of a variety of issues.

Methods such as photo elicitation and photovoice are under the umbrella of ABR methods. Photovoice researchers have participants take a photo about an issue, experience, or other prompt and describe the details of the photo, including their feelings taking the image and rationale for how they framed the subject (Catalani & Minkler, 2010; Harper, 2002). In the field of agricultural communication, Borron (2013) employed photovoice for examining participant experiences in an Extension Expanded Food and Nutrition Education Program (EFNEP), and Rodriguez and Bjelland (2008) utilized photo-elicitation to explore the community development needs and priorities of Chinese village residents. Participatory video (PV) is another arts-based method that typically involves video professionals working with research participants to co-construct videos of experiences, perceptions of community issues, and arrive at an ultimate call for improving the issues (Mitchell & de Lange, 2012). Instances of PV were not found in the agricultural communication literature to date. Hence, researchers in this study piloted ABR photo elicitation and PV methods as a potential new means for agricultural communication scholars to consider for future research examining workshop participants' learning and experiences. The following section describes how the purpose of this study existed at the intersection of an interactive agricultural communication workshop, instructional design, and piloting ABR methods for assessing participant experiences.

Purpose and Research Questions

To facilitate and increase global collaborations, the USDA Foreign Agricultural Service (FAS) utilized the Cochran Fellowship Program with short-term training opportunities to connect international researchers and scholars with "U.S. universities, government agencies, and private companies" for "hands-on training to enhance their technical knowledge and skills related to agricultural trade, agribusiness development, management, policy, and marketing" (USDA, 2017a, para. 1). As the U.S. had already introduced GMOs, an opportunity existed for Cochran fellows from Asia to interact with American scientists and industry to learn more about safety and regulatory procedures. University of Nebraska-Lincoln's (UNL) proposal was funded to develop and implement a training for Cochran fellows from Indonesia to engage with U.S. scientists about biotechnology methods and regulations. The authors of this study were included in the training to support the USDA's objective to train scientists how to share GMO information with public audiences.

The purpose of this study was to (1) develop an active, project-based learning biotechnology communication workshop utilizing mobile multimedia technologies for Indonesia Cochran fellows during their time at UNL, and (2) pilot test ABR methods for exploring the fellows' backgrounds, biotechnology views, and workshop experiences. Participatory arts-based methods of photo and video creation were employed in this case study to potentially uncover and demystify participants' thoughts and experiences about biotechnology and with the U.S. biotechnology training program. Research questions included:

1. What images and videos will Indonesian fellows capture with iPad multimedia kits to demonstrate points of interest and their learning during a U.S. biotechnology training program?
2. What interview questions and topic flow will Indonesian fellows develop and follow for conducting co-constructed interviews about biotechnology and their training experiences in a Cochran Fellowship program?
3. How do Indonesian fellows define biotechnology/genetically modified organisms (GMOs) for lay audiences, after participating in a science communication training? What problems do they identify as being solved by biotechnology?
4. What biotechnology issues, cultural considerations, and/or other discussion points emerge from participants' co-constructed video interviews?

Methods

Research Context

The case examined in this study was a 2016, two-week biotechnology training developed and implemented at UNL for the USDA Cochran Program for Agricultural Biotechnology (Indonesia) – Asia Region. Case study design (Yin, 2011) was utilized for investigating a science communication training and learning within a real-world context. The 11-day training program in July – August 2016 focused on working with selected Indonesian researchers and scholars to help them learn: U.S. biotechnology regulations, biotech crops history and development, environmental safety, food safety, animal and human safety, drought stress tolerance, disease resistance, food allergies, and science communication. The fellows toured university greenhouses and laboratories and the headquarters of an internationally known biotechnology and seed sales company. The fellows ended their trip with a visit to government agencies in Washington D.C.

Four U.S. scientists in the areas of food science, plant pathology, Extension entomology, and agricultural economics participated in training implementation. Two of this paper's authors from a science communication academic program were also invited to develop three training sessions related to science communication topics outlined by the USDA: (a) "perspective and viewpoint of GMO foods from producers, manufacturers, and public interest groups" and (b) "best practices for GMO knowledge sharing with the public" (USDA, 2017c, p. 1). The science communication trainings took place at the beginning, middle, and end of the fellows' two-week visit to UNL. Trainings were designed to include discussion-based presentations covering science communication and science literacy broadly, and more specifically, public perceptions, media coverage, strategies for defining biotechnology for lay audiences, and how to communicate key biotechnology points in media interviews. Fellows were then taught how to use iPad multimedia kits for taking photos, shooting video, and recoding practice interviews about biotechnology. Hence, the science communication portion of the fellowship was not only an active learning process, but also a participatory ABR endeavor. Fellows were trained not only how to be interviewed about biotechnology concepts, but also how to conduct interviews and shoot photos and video.

Participants

The Cochran Fellows were competitively selected by the USDA's FAS based on their "qualifications and training priorities identified by the U.S. Embassy in Indonesia." They included "mid-level agricultural managers", plant pathologists, and veterinarians (USDA, 2017c, p. 1).

Study participants were recruited from the participating fellows. The university's Institutional Review Board (IRB) board approved the communications study. Fellows were not required to participate in the study and gave voluntary consent. Study participants included six women and two men from Indonesia with higher education degrees. All were employed in agricultural and environmental sectors with interests in learning more about biotechnology connected to their work. Table 1 highlights participants' demographics. Pseudonyms are used to protect identities.

Table 1.

Participant Pseudonyms and Demographics

Pseudonym	Gender	Education	Profession
Irwan	Male	Masters	Ministry of Environment and Forestry
Rini	Female	Masters	National Agency for Drug and Food Control
Dian	Male	Doctorate	Indonesian Institute of Sciences
Melati	Female	Doctorate	Bogor Agricultural University
Irene	Female	Doctorate	Indonesia Center for Animal Research and Development (ICARD)
Lia	Female	Doctorate	Indonesian Research Institute for Animal Production
Gitta	Female	Masters	USDA, US Embassy in Jakarta
Sunny	Female	Masters	Ministry of Agriculture
Paul	Male	Doctorate	Department of Agronomy and Horticulture
Greg	Male	Doctorate	Extension Entomology

The participants chose their level of permission on consent forms for allowing use of the images and videos they captured as research data, as well as their level of consent for showing or blurring their faces and voices. All the participants consented to allowing their images to be used and faces to be shown for academic research presentation and publication purposes.

Participatory Arts-Based Approach

Since mobile devices are accessible around much of the world and are heavily utilized in the current Information Age for media consumption and creation, researchers loaned each fellow an iPad multimedia kit and instructed them how to use it for capturing photos and videos for the duration of their visit. The first communication workshop included how to use the iPads and photography and videography techniques such as framing and composition. Participants were asked to take up to three photos and one video each day of what they learned or found interesting during their trainings and tours with U.S. biotechnology scientists. Fellows also participated in hands-on activities for developing interview questions and responses, shooting interviews, and being interviewed for the purposes of defining biotechnology in simple terms, along with discussion of biotechnology in Indonesia.

Workshop content and instruction regarding conducting interviews included guidance for asking questions about the who, what, when, where, why, and how of a subject. The researchers discussed the difference between objective (factual) and subjective (emotional) interview questions, as well as interview etiquette for microphone placement, framing, introductions, question organization, and concluding interviews with the question of: "Is there anything else you would like to add?". Participants were broadly instructed to work in pairs to develop questions to ask one another in post-training co-constructed video interviews regarding biotechnology and their experiences in the fellowship program. At the end of the two-week training, the fellows and authors viewed the fellows' photos and videos. The fellows also worked in pairs to co-conduct post-training interviews with one another about biotechnology and reflection on their learning.

Data Sources and Analysis

Researchers collected and triangulated multiple data sources in this study to establish rich, vivid, and descriptive understanding of the Indonesian fellows' perspectives and experiences in the training (Schwandt, 2015). Trustworthiness was established in this study by triangulation of the multiple data sources, multiple researchers reviewed the data and findings, researcher observations, and thick description provided via participant interview quotes, photos, and videos (Korstjens & Moser, 2018). Data included photos, videos, and interviews captured by participants with iPad multimedia kits. In the communication focused workshops, the lead researcher taught participants photo, video, and interview theory and techniques. Participatory video methods often include a videography professional guiding and facilitating participant creation of video around issues impacting participants' lives (Mitchell & de Lange, 2012; Yang, 2013). By the end of the two weeks, there were eight participant-to-participant interviews and two interviews where participants asked questions of a university biotechnology scientist and an extension biotechnology expert. Each interview was 15-20 minutes long and consisted of semi-structured participant developed questions.

Researchers transcribed and open-coded interviews for identifying categories of repeated information across interviews (Saldaña, 2016). For instance, participants frequently mentioned Indonesia's need for establishing biotechnology regulations, which emerged as a category of 'regulation' during open-coding. Researchers confirmed categories and next, axial coding (Saldaña, 2016) was conducted to combine codes into emerging themes. While open and axial coding are ideal for allowing the emergence of categories and themes, the data was also analyzed using a deductive approach through which pre-determined codes drive the grouping and analysis of the data (Yin, 2011). Specifically, a deductive lens was used for examining interview transcripts for how participants created the structure, flow, and organization of questions into an introduction, body, and conclusion for conducting their interviews, as well as how participants explained biotechnology and its potential for solving food insecurity related problems. In addition, all participant photos were deductively coded and categorized for images depicting locations including classrooms, field sites, laboratories, and candid lifestyle photos from their apartments, van rides, and a university stadium tour. Researchers independently coded, compared, and confirmed a sample of the photos as representations of each of the categories.

Results

This study presents detailed photo examples and quotes from participant created mobile multimedia. The following sections describe the results connected to the four research questions focused on participant captured media, interview organization, biotechnology definitions and solutions, and biotechnology implementation issues and concerns. It is important to note the participants had high-level skills in speaking English as a second language. However, there is still a possibility that researchers misunderstood some of the nuances of the participants' speech and meaning. The researchers' intention is to present the following findings in a culturally sensitive manner.

Participant Captured Multimedia (Research Question One)

Participants surpassed taking three photos a day via the iPads. Many of them already owned and were familiar with using mobile phones with similar camera technology. Three of the participants took more than 200 photos during the two-week fellowship, while fifteen was the lowest number of photos taken. Most participants appeared to take between 25-50 photos. Table 2 outlines individual participant's captured photos.

Table 2.

Participant captured photos

Pseudonym	Field Sites	Laboratory	Classroom	Daily Life	Total Photos
Irwan	109	37	1	72	219
Rini	0	0	9	6	15
Dian	20	1	0	0	21
Melati	11	40	5	0	56
Irene	77	21	3	104	205
Lia	24	0	9	0	33
Gitta	141	86	19	9	255
Sunny	18	8	7	0	33

Field sites such as the high-technology greenhouse on the university's Innovation Campus and a USDA research center in the south-central portion of the state were the most popular spots for photography with a total of 382 images. Candid daily life photos such as tours of the university's football stadium, an aerospace museum, apartment life, and western restrooms were second with 191 images taken, and university and industry biotechnology laboratories were third with 185 photos. A classroom on the university's campus was used for much of the training presentations. Participants took 27 photos in that space.

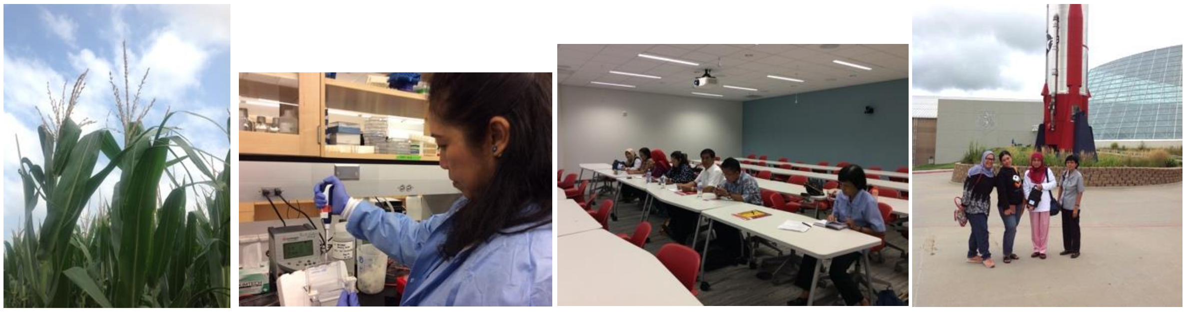

Figure 1. Examples of field site, lab, classroom, and candid photo classifications

It is possible the participants practiced various photography techniques presented in the science communication workshops. Their photos demonstrated a variety of wide, medium, and close-up photos from a variety of angles. For instance, Irwan captured multiple photos of varying framing and vantage points to tell the story of the fellows' tour of a university research field site. The images provide some insight into Irwan's observations and subjects that caught his eye.

Figure 2. Series of Irwan's research field site photos

Researchers also asked participants to record up to one video per day of the training. Melati recorded 16 videos, while Rini and Dian did not record any. The other participants recorded between two to six videos. Most of Melati's videos focused on laboratory demonstrations and greenhouse research technologies.

Interview Structure and Flow (Research Question Two)

The participant to participant co-constructed interviews appeared to follow similar organizational patterns. One participant would serve as the interviewer, and the second as the interviewee. Then, participants would switch roles (Figure 3). The interviews used the following format: (a) introductions, (b) job description/ background, (c) biotechnology definitions, (d) biotechnology thoughts and opinions, (e) biotechnology issues (climate change, food security and safety, drought, regulations), (f) public engagement (challenges, importance, opportunities) (g) future of biotechnology (plans, hopes, ideals), and (h) conclusions (wrap-up, thank you).

The participants followed the workshop instruction for interview question laddering and flow for the combination of objective and subjective questions, as well as etiquette for introductions and conclusions. In the interviewee role, participants had the opportunity to provide their opinions about biotechnology and Indonesia's context. As outlined in the subsequent themes, participants' perceptions of biotechnology issues and concerns and public engagement emerged as points of discussion within the interviews. Most of the interviews ended on a positive note with participants looking to a successful future of biotechnology integration in Indonesia.

Figure 3. Co-constructed participant video interviews

As part of the researchers' request for participants to record up to one video a day, three of the participants worked together between workshop sessions to interview a university biotechnology scientist (Paul) and an Extension entomologist (Greg) who provided training during the fellowship program. The organizational structure of the two scientist interviews proved to be similar to the participant-participant interview flow described earlier. It seemed the participants were most interested in hearing the scientists' explanations of GMO technologies and disadvantages, as well U.S. biotechnology regulation procedures. The interviews also had a focus on the public's misunderstanding of biotechnology and GMOs, as opposed to methods for positive public engagement and education.

Biotechnology Definitions and Potential Solutions (Research Question Three)

Each interview transcript was also deductively reviewed for approaches participants used to define and discuss biotechnology. Many of the participants' definitions of biotechnology acknowledged its complexity. For instance, Dian expanded biotechnology beyond food and said, "Biotechnology is a combination of many things, actually. It is a different field of activities related to the development of the improvement of biological products and food, vaccines, and drugs." Several of the participants focused their definitions on genetic processes and benefits. Sunny said, "Biotechnology is one way to improve food agriculture. The gene can improve the quality of life or the production."

Some participants specifically discussed the science of GMOs as an example of biotechnology. Irwan had recently switched positions from forestry to an emphasis on biotechnology. He described:

> At the first time, I think GMO is very scary. I think it's a big great organism like a monster. That's the first time. But now, I have just learned about GMO. That it is a single gene. It's not a monster. It's just an organism.

Genetics and GMOs proved to be challenging for participants to explain in succinct terms for lay audiences. Irene practiced defining GMOs, but the description she gave was still challenging to follow:

> GMO is a genetically modified organism. That is the organism from other living organisms. They put the DNA from the organism and insert it into another, maybe the product or other organism, so we call it a genetically modified organism, when we have already the new construct of the new organism that already had the insert from the other organism.

Participants typically described biotechnology in a positive light and connected it to broader global challenges such as feeding the world. Sunny described the need for improving agricultural viability and production. She said, “It’s important the farmers have many options to choose how to improve their crops or property.” Irene connected GMOs to increasing food production for a growing population:

> Because Indonesia is such a big country, and we have a large population, we need to feed the people. We need to feed the people. That means that we need the food, and with the GMO, we hope that we can have the product with the higher yield and with the higher production and good quality of course, and safe for the people in Indonesia.

Dian linked biotechnology to the issue of climate change and described the need for developing drought resistant plants. He stated, “We have to conduct research related to the impact of climate change on agricultural activity. For example, we have also research on plants that might grow in saline soil and also, in a drought problem.” By situating their definitions and descriptions of biotechnology and GMOs in larger societal issues, participants demonstrated their learning from the training sessions where researchers encouraged participants to zoom out and connect their work to the bigger picture as a potential hook for appealing to consumer and public audiences’ concerns about biotechnology impacts on their daily lives.

Regulation Uncertainty (Research Question Four)

The co-constructed participatory nature of the interviews allowed for a richer, emergent understanding of the participants’ learning goals for their time in the fellowship program, as well as their biotechnology implementation questions and concerns related to their country’s context. Much of the participants’ interviews focused on Indonesia’s hesitation with biotechnology due to regulation concerns, and the participants’ desire to gain more insight from U.S. regulatory measures. Sunny described, “There is no biotechnology in Indonesia because today, we have no regulation for monitoring and evaluation after commercializing biotechnology.” Dian said, “We have to comply with all the biotechnology law and containment in our work. We have to comply with all the regulation provided by the WHO (World Health Organization).” Gitta also discussed food safety challenges, but she made the additional point that Indonesians also expect food production to meet their personal beliefs:

> Because it’s Indonesia, they accept this biotechnology with a cautionary approach. I think it’s good to make a standard all the GM products have to comply with for food and environmental safety. Also, we consider other things such as the norm, socioeconomic, and also, religion.

Islam is the largest religion in Indonesia. Food is expected to be served following ‘halal’ (permissible) standards for specific guidelines for animal slaughter and prayer.

In the two interviews participants conducted with university scientists, they also brought up the issue of regulation. Sunny asked Greg what his opinion was of genetically modified foods. Greg responded:

> In my opinion, they're just like any other biotechnology, they need a thorough background screening and study. We need to have a strong scientific foundation in all the parameters that we can conceive that would deliver risk, either to you or me, or risk to the environment, or risk to the market. In my opinion, those three areas are important considerations any time we bring a new biotech trait into the forefront. Once we do that, as a society we need to recognize the valid protocols that we have in place that we use to screen these products as safe.

Melati followed up with an additional question indicating concern that GMOs would lead to a decrease in farmers' knowledge and skills over time, as producers will become more reliant on biotechnology. Greg discussed how Extension plays a role in continuing education for agricultural professionals, and specifically, there is a need to train farmers about new pest resistance strategies for genetically engineered crops. He said:

> We see a pest, it reaches a certain number, we use integrated pest management scouting procedure to respond to it. If we have a genetic engineered trait, we plant the seed and it's expressed in the plant, but we can't control that, we can't respond to that. So, we do give up a little bit of our management flexibility in deploying those. That's why we become so much more reliant on resistance management procedures to try to conserve that trait.

Observations of participant questions and discussion during training sessions, as well as coding of interviews showed GMO labeling was also of trepidation to the participants. The training took place amidst a controversial time in the U.S. when President Obama signed a bill overturning a Vermont GMO labeling law (Dinan, 2016). Most of the Cochran scholars appeared to favor investigating and potentially implementing measures in Indonesia for labeling genetically engineered foods with safety labels. Rini described how the labeling process would ideally work in Indonesia, "I think GM products are now assessed by government and then, government puts a food safety certificate on that. I will trust the GM food that has the certificate of food safety." Hence, many of the participants wanted to pay great attention to strategy for regulation, assessment, and labeling for a smooth biotechnology implementation. They tied food labeling to providing consumers a sense of food security and safety.

Informed Public Decision-Making (Research Question Four)

The final theme that emerged from participant-participant and participant-scientist interviews was the importance of increasing public understanding of science and biotechnology for making informed decisions about behaviors such as food purchases, nutrition, and health. Participants described that a learning curve exists for the public and even some scientists, when it comes to developing an understanding of biotechnology. Lia discussed the challenge of educating audiences about the complexities of food science:

> GMOS are still a challenging science, especially in Indonesia because not all the people in Indonesia understand what a genetically modified organism is. Even the scientists, not all the scientists understand what a genetically modified organism is.

> But to me, GMOs should be more exploratory. What are the advantages? What is the benefit for the human being?

Similarly, Melati described her perception that not only the public, but also producers in Indonesia grapple with biotechnology concepts and application:

> I have talked several times with regular people and sometimes with farmers about biotechnology. I get different kinds of feedback from them from different perspectives. For farmers, for example, not too many farmers know about biotechnology. Some of them know GM, for example GM crops, they are not sure whether GM crops will help them to increase the productivity of their crops first. Second, they are not sure whether the GM product is safe for food, for example something like that.

Based on the data, the participants intended to find a way to ensure a smooth biotechnology implementation in Indonesia through understanding scientist, producer, and consumer perspectives and concerns about biotechnology.

The participants considered science-based communication strategies for openly sharing research information for potentially shifting possible negative opinions and attitudes about GMOs to more positive perceptions of the technology. Irene said, "The scientists have data, scientific data, valid data, right? So, using this data, they should be able to convince the public, the farmers, and/or policymakers that GM crops are safe and will increase their crop production. That's the way." Extension entomologist Greg reinforced the conversation around the need for clear science-based communication:

> What scientists need to do is become a little bit better communicators and part of that is just being able to vocalize better and to sometimes speak in simple terms, which can be challenging for scientists, as we get stuck with all of our scientific jargon that we use. So, we have to try to cull out that jargon that we use on a regular basis and to feel free to open up about our communication and the science that we do.

University biotechnology scientist Paul expanded on the discussion and added the element of trust as a factor in science communication and public understanding:

> Most of these groups either don't understand science very well or they have some kind of political agenda. They tend to be against big companies, in general, and don't trust big companies, and they also don't trust the government to regulate their foods. So, if you're not trusting the companies, and you're not trusting the government, you tend to be afraid of everything. Biotechnology is just one of those things people have a fear of because they don't understand it.

Ultimately, many of the participants arrived at the final point that it is up to each individual consumer within the public to make her own personal decision about whether to trust scientific information shared by university and industry researchers for GMO consumption. Sunny stated, "We just give the truthful information based on the scientific evidence. We are honest about the possibility of GM. So, all the people and all the public can choose what they want and what they need." Rini said, "I think biotechnology is one of the solutions for food security in our country. That will be a choice for consumers to consume the product." Sunny returned to the participants' overarching aim to determine proper regulations and potential labeling of biotechnology products for ultimate scientific transparency for public decision making. She concluded, “We can make people know, and they can choose what they prefer: GMO food, or no. If there is no GMO label, nobody will know if there is a GMO or not.” From considerations of public perceptions to regulatory measures, the fellowship training program appeared to stretch participants’ thinking and understanding of biotechnology practices and implementation strategies through insights into U.S. scientists’, industry, and professional science communicators’ experiences.

Limitations

The limitations of this study included a small purposive sample size. A larger number of interviews may have provided more understanding of emergent discussion points about cultural and religious values related to biotechnology. While the sample was small, multiple sources of data were collected with participatory approaches for capturing thick description of participants’ thoughts and experiences (Yin, 2011). Additional limitations were the short two-week duration of the training and potential cultural and language misunderstandings between participants and the researchers. Also, member-checking for this study was only conducted with the participating scientists and not the participating Cochran fellows, as follow-up via email proved not to be feasible due to time and language constraints. When asked via email to select up to five photos that best demonstrated their experience and learning, a participant instead selected five photos she took of the lead researcher and wrote about what the researcher was teaching in each photo. For future applications of ABR methods with international populations, researchers might have more success clearly explaining and implementing follow-up interpretation steps in-person rather than via e-mail. The lack of member-checking also limited researchers’ interpretations of photo and video meanings, framing, and composition. However, researchers compared codes for consistency in understanding across their interpretations.

Discussion and Future Research

This study piloted participatory ABR methods for better understanding Indonesian participants’ experiences and perceptions of a U.S. based biotechnology training program. Participants used mobile iPad multimedia kits with ease for capturing videos, photos, and interviews highlighting their time and learning in the program, as well as insights into their thoughts on biotechnology implementation in their home country of Indonesia. Participants demonstrated their understanding and learning of science communication concepts taught in the training via photos and co-constructed video interviews.

ABR can uncover participants’ inner thoughts and perceptions (Barone & Eisner, 2011). The methods used in this study brought participants’ thoughts on biotechnology to light. Through the co-constructed interviews, it became apparent the participants appreciated and identified benefits of biotechnology for increasing crop production to feed a growing population, adapting to climate change, and developing drought resistance, yet they were concerned about regulating the technology to address Indonesian citizens’ religious values, lifestyles, and nutritional concerns. The participants had hoped the fellowship training would have had more of a focus on these areas and specifically wanted more information about regulatory measures. Hence, it is recommended similar future training programs conduct a needs assessment with participants ahead of training development and implementation, to better understand participants’ international contexts, cultures, and learning goals for tailoring the learning objectives to meet their needs. This could mean potentially allowing more time between the funding of training proposals and actual implementation for organizers to interact with participants, before the participants arrive in the U.S.

It is imperative that similar international trainings be designed with participants' culture and backgrounds in mind. The culture centered communication approach (CCA) has predominantly been applied and researched in health communication, but it could also be effective in the agricultural and environmental disciplines (Dutta, 2008). CCA is the examination of communication between structure (the dominant force/group), culture (norms, beliefs, values), and agency (individuals) (Dutta, 2008). The approach is meant to provide space for those in the minority and marginalized groups to have a voice through participatory projects. Taking this view, the USDA and university organizing the biotechnology training are the structure, the Americans and Indonesians have two different cultures, and the participating scientists and fellows all have individual agency. Agencies and scientists could co-design biotechnology training programs with participants from other countries to more effectively include a focus on the culture and values of participants' country and their individual learning goals for attending the fellowship. Also, specific sessions could be incorporated into the training for participant reflection via journaling, focus groups, and project co-construction for developing a more holistic understanding of participants' experiences, learning, and goals.

There is also opportunity to increase the participatory nature of the methods piloted in this study to move beyond simply quantifying photos and videos and coding co-constructed interview transcripts. For example, Borron (2013) pointed out that photovoice is a method through which participants not only capture photos, but they also explain their images to arrive at selecting photos for reoccurring points of conversation and shared experiences to reach participant-researcher co-constructed themes. While this study engaged participants in capturing media and co-constructing interviews, participants did not play a major role in interpreting the data.

In addition to furthering ABR in science communication, there are multiple strands of future research that could progress from this study. It appears the USDA and higher education institutions will continue to invite international participants to campuses for meeting, learning from, and collaborating with U.S.-based scientists about a variety of innovative scientific techniques for improving controversial issues such as climate change, food technology, and water quality. Science communication faculty should engage with scientists to investigate the social and educational aspects of these training contexts for attempting CCA approaches for understanding international participants' perspectives to develop strategies for communicating agricultural and environmental scientific research to international communities. Also, data gathered from these trainings could be utilized to develop and provide case-based instruction in undergraduate and graduate science communication courses for examining critical food, energy, water, and sustainability issues from international participants' perspectives for developing science communication professionals to consider issues on cultural and global scales.

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