GREAT Expectations: building a model for applied gender training for crop improvement

Hale Ann Tufan[†][*], Margaret Najjingo Mangheni[◇], Brenda Boonabaana[§], Elizabeth Asiimwe[○], Devon Jenkins[†], & Elisabeth Garner[†]

[†] *Department of Global Development, Cornell University, Ithaca, NY, USA.*
[◇] *Department of Extension and Innovation Studies, Makerere University, Kampala, Uganda.*
[§] *Department of Forestry, Biodiversity and Tourism, Makerere University, Kampala, Uganda.*
[○] *Gender-responsive Researchers Equipped for Agricultural Transformation (GREAT), Makerere University, Kampala, Uganda.*

[*]*Corresponding author. Email: hat36@cornell.edu*

Capacity development is a critical entry point for integration of gender responsiveness in agricultural development, yet there is little reflection on who should be trained, on what, and how. As an opening paper to this special issue, we ask: What are key aspects of a gender training program that seed attitudinal shifts and practice change in agricultural research teams? To answer this question, we explore how the Gender-responsive Researchers Equipped for Agricultural Transformation (GREAT) project has pioneered a training model that seeks to challenge the status quo of crop improvement research, questioning norms and focusing on attitudinal shifts and practice change. We examine the project design, execution and iteration, practical constraints, and impacts on participants. We conclude that GREAT demonstrates the importance of a feminist gender training program for effective social change, with future work needed to deepen exposure to feminist theories and testing models of pairing learning with collaborative research engagements.

Keywords: Gender Training, Agriculture, Interdisciplinarity, sub-Saharan Africa, Gender Research.

Introduction

Twenty-five years after the Beijing Declaration, it remains imperative to place gender equality and women's empowerment front and center of the development agenda. At this time of renewed donor investment and interest in agricultural development, attention to gender issues has followed suit. Gender training – in the form of short training courses, covering topics related to concepts and issues around gender equality and women's empowerment – has become a panacea for gender inequality (Ahikire 2007). While capacity development is a critical entry point for gender integration in agricultural development (Njuki 2016), there is little reflection on who should be trained, on what, how, and by whom. Instrumentalizing theoretical concepts of power and social change to reductionist skill-building exercises avoids challenging the internalized norms and beliefs of trainees, especially those from positivist biophysical science backgrounds (Mukhopadhyay and Wong 2007). Devoid of self-reflection, critical engagement, or practical application, gender training in East Africa remains skin-deep (Mangheni et al. 2019). In continuing with conventional trainings, we risk perpetuating inequality through research systems that continue with business as usual and lack the ability to challenge the status quo.

In this context, the Gender-responsive Researchers Equipped for Agricultural Transformation (GREAT) project, a collaboration between Makerere University in Uganda and Cornell University in the United States, pioneered an alternative training model, which seeks to challenge norms of crop improvement and agricultural research more generally, questioning entrenched norms and focusing on attitudinal shifts and practice change. The GREAT model rests on four pillars: 1) self-reflection; 2) interdisciplinarity; 3) applied learning; and, 4) enabling environment and learning community. The course consists of a sandwich model: two parts of in-person teaching bookended by a four-month applied field-training component aimed at enabling social scientists and biophysical scientists, largely coming from the National Agriculture Research Institutes (NARIs) in sub-Saharan Africa (SSA), to learn through practice while gaining research capacity in gender-responsive agricultural research. The highly competitive course based at Makerere University had four open-application cohorts since 2016. In addition to these application rounds, GREAT continues to deliver a series of shorter, customized courses for institutions and projects, which are on a request basis.

This special issue explores the foundations of the GREAT model as it was developed, tested, and implemented over five years (2016-2021). This introductory paper outlines the genesis

of the GREAT program, and it is followed by an accompanying paper by Travis et al. on the GREAT monitoring, learning and evaluation (MLE) approach. The third paper, by Mangheni et al., outlines the competency framework developed and deployed to assess the trainers' competencies for GREAT. The concluding paper exemplifies how the development of GREAT has generated broader impacts for agricultural research in development, outlining a framework for designing and tracking the gender responsiveness of agricultural research (see Mangheni et al., this issue).

This paper is organized as follows. We begin with a literature review on gender training, which helps us to situate the GREAT program within a broader analytical context. We then introduce two conceptual frameworks to answer our key research question: What are key aspects of a gender training program that seed attitudinal shifts and practice change in agricultural research teams? This is followed by an exploration of the four foundational pillars that underlie the GREAT conceptual framework and by a conceptual mapping of the GREAT training curriculum design elements, which serve to illustrate the skills and capacities that the GREAT training program offers to participants. We then draw from MLE data collected over five years to reflect on the effectiveness of the GREAT course as a gender training program that seeds attitudinal shifts and practice change. In the conclusion, we reflect on the successes and challenges experienced within the GREAT training model and draw fruitful lessons for future feminist gender training programs.

Literature Review

The trouble with gender mainstreaming

Twenty-five years after Beijing 1995 set a global agenda for achieving gender equality and women's empowerment, these goals have become instrumentalized. The formative previously close relationship between gender and feminism has been interrupted (Mukhopadhyay 2014), delegitimizing and marginalizing feminist approaches in the process. The reframing of gender equality away from the Beijing Platform for Action and towards the Millennium Development Goals underlies this paradigm shift (Kabeer 2005). Progress towards sustainable development goals has been challenged by hostility to women's rights and activists, and the top-down style of the goals themselves (Esquivel and Sweetman 2016).

Gender mainstreaming can play a key role to achieve the once feminist goals of gender equality and women's empowerment (Moser and Moser 2005). However, feminist critiques note that institutional integration rather than transformation have weakened the meaning of these objectives and their intended transformative power (Cornwall et al. 2007; Hafner-Burton and Pollack 2002; Porter and Sweetman 2005; Walby 2005). Gender focal points, or experts, further weaken the transformative power of these goals, by fostering institutional (i.e., neoliberal) priorities and cultures that counter gender-transformative goals, limit feminist action, or change goals' individual expectations and objectives over time (Ferguson 2015). The pervasiveness and acceptance of the "language of gender equality" by donors, governments, and multilateral agencies reflects a weakening of the term's meaning and political roots (Cornwall and Rivas 2015). As a result, there is a regressive reframing of gender in development programs, which tend to justify gender equality as a "business case" (Ferguson 2015), requiring simply to "add women and stir" (Subrahmanian 2004).

Gendered technology and innovation processes

Agricultural innovation spans technological outputs, organizational innovation within institutions, and innovation of systems (Leeuwis 2013). Technological innovation adoption is not only shaped by social identity, institutions, norms, lived experiences, and beliefs, but also by interactional social collective processes (Leeuwis and Aarts 2021). The history of gender integration into agricultural research has followed dominant paradigms in agricultural development and gender theory (Okali 2012), including the instrumentalization and reductionist approaches described above. The outputs of agricultural research take form as new technology and innovations, where addressing gender issues remains an afterthought, retrofitted to established research projects in isolated sections.

Gender is embedded in the sociotechnical process in a relationship that is shaped by power and agency (Wajcman 2010). This becomes particularly important in innovation processes in development, where social identity, geographic context, and innovation are inextricably linked, and where innovation is embedded in and defined by local contexts (Blake and Hanson 2005). A body of literature documents how gender issues shape agricultural innovation, from the technology development process (Schut et al. 2015) to access to inputs that shape adoption (Doss and Morris 2001). Yet, there is still a lack of academic attention to gender relations, power, and agency in agricultural innovation systems (Kingiri 2010; Mbo'o-Tchouawou et al. 2016). Zooming in on crop improvement[1] as an innovation process and on new crop varieties as the technologies that are developed, the same problematic historical indifference to gender relations, power, and agency persists. This calls for interdisciplinary research and gender expertise which can better understand observed differences in the preferences of men and women across crops and contexts (Weltzien et al. 2019). Building such interdisciplinary crop improvement teams requires critical reflection on current practices, power dynamics, and, importantly, how to build common understanding and values towards gender equitable innovation processes.

Gender training: getting it right?

There is widespread acceptance of capacity development in gender-responsive research (GRR)[2] as a critical entry point for integration of gender responsiveness in agricultural development (Njuki 2016), yet there has been little attention to *who* is trained and *how* in the agricultural development sphere. Gender training has long garnered seething critique from academics and practitioners alike. Mukhopadhyay (2014), for instance, describes how short training events are reduced to checklists, skills, and

information that trainees can easily apply. Chant (2012) talks of tactical slogans of inoffensive gender knowledge that do not alienate participants or managers. Mukhopadhyay and Wong (2007) observe that many gender training programs solely focus on skills, visibly refraining from challenging negative behaviors and attitudes and significantly simplifying complex theoretical concepts of power and social change, especially when positivist biophysical scientists are involved. Participants are often not asked to confront their positionality and biases, steering away from complex or academic ideas in order to avoid being mischaracterized as political (Ferguson 2015). Gender training has therefore increasingly become a conduit for neutral definitions rather than an opportunity for self-reflection and engagement (Ahikire 2007). Training events become spaces where it is allowed to talk about gender as a concept as long as it does not challenge participants or ask them to change their assumptions, beliefs, and behaviors (Ferguson 2015).

A review by Mangheni et al. (2019) of gender training programs in East Africa targeting agricultural researchers reflects broader critiques of gender training, showing that these programs are rigidly built on certain frameworks and narrowly focused on raising awareness rather than on addressing the root causes of gender inequality. Agricultural gender training programs should emphasize the necessity to develop a consciousness of gender inequalities and of how they are socially constructed (Sarapura Escobar and Puskur 2014), so that agricultural researchers can be exposed to the root causes of gender inequality, understand their own roles in reinforcing or challenging these inequalities, and become active agents of change for more just and equitable societies. Training programs should convey a feminist research ethic that empowers participants, amplifies marginalized voices, minimizes power and hierarchy between researchers and participants, and facilitates equitable sharing of thoughts and opinions as well as shared reflexivity (Oakley 1981).

GREAT conceptual framework: avoiding more of the same

Building a gender training program that avoids committing similar mistakes requires to address the limitations and opportunities described above. Njuki (2016) offers an elegant four-level classification of gender capacity development for agricultural
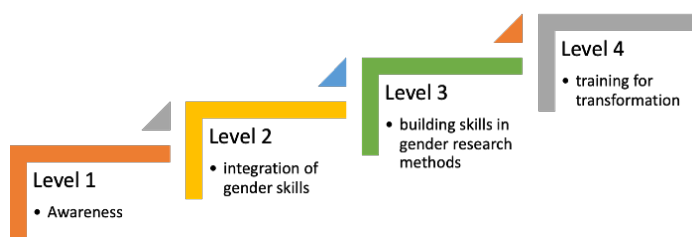
researchers aiming at transformative change (see Figure 1): first, creating gender awareness; second, integrating gender skills; third, building skills in gender research methods; and, fourth, training for transformation.

Drawing from feminist approaches to gender training, Ferguson (2019) proposes to use the KDA approach – namely Knowledge (on the desired change), Desire (what is valued, feared, desired), and Abilities (of articulation, reflection and communication) – for training programs targeting effective social change (see Figure 2). Training that contributes to effective social change must address all three dimensions: indeed, knowledge alone will produce trainees who know facts but lack the desire or ability to make a change; knowledge and desire, without the abilities to make a change, will engender frustration; and training that combines knowledge with abilities will form trainees who, albeit being well equipped, do not have a deep commitment and desire to generate lasting social change (Ferguson 2019).

Drawing on both Njuki's (2016) and Ferguson's (2019) conceptual frameworks, and on the literature presented in the Introduction, we return to our main research question – what are key aspects of a gender training program that seed attitudinal shifts and practice change in agricultural research teams? – to explore the four foundational pillars of the GREAT conceptual framework: self-reflection, interdisciplinarity, applied learning, and an enabling environment and learning community. We describe each of these four pillars below, and how they function as key aspects of a gender training program that seed attitudinal shifts and practice change in agricultural research teams.

Self-reflection

The starting point for transformative training outcomes should be the provision of a space for reflection on internalized gender beliefs, biases, and identities. This serves as a springboard for questioning deep-seated inequalities and norms. A clear attitude change among participants raises the chance of unlearning the biases that perpetuate gender inequality, increasing participants' willingness to make adjustments and to transfer the newly
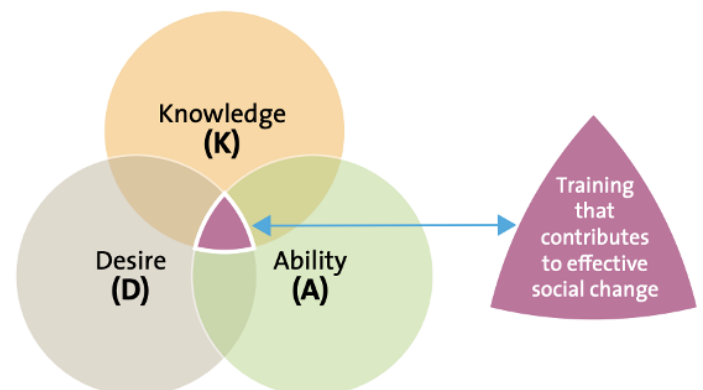

Figure 1 Skills and capacities for gender integration in agricultural research (based on Njuki 2016).

Figure 2 Knowledge, Desire, and Ability: the KDA approach to training for effective social change (based on Ferguson 2019).

acquired knowledge and skills to their workplaces (Sarapura Escobar and Puskur 2014). Knowledge of both the root causes and consequences of gender inequality enables participants to better understand the relevance of gender issues in agriculture, and why they should pay greater attention to gender relations in their work. Such reflexivity on power dynamics, inequality, empowerment, and gender transformation underlies principles of feminist gender research in agriculture (Tickamyer and Sexsmith 2019). The self-reflexivity pillar closely relates to the *knowledge* and *desire* dimensions of the KDA framework: in designing the curriculum of the GREAT project, we decided to sequence the training so that participants could first acquire the *knowledge* of root causes of gender inequality in agriculture and why gender issues matter in agricultural research (see Figure 3), and subsequently nurture the *desire* to become agents of change who can fruitfully contribute to overcoming these inequalities.

Interdisciplinarity

Gender studies and agriculture are two distinct disciplines, each anchored in bodies of knowledge governed by well-established ontologies and epistemologies. Questioning assumptions in one's discipline is not only critical to shifting thinking and practice of research groups, but it is also highly desirable when interpreting research from other disciplines (Moon and Blackman 2014). Interdisciplinarity is foundational to feminist gender research in agriculture (Tickamyer and Sexsmith 2019), allowing participants to critically engage with the subject matter and enabling them to question the validity of qualitative and quantitative data as well as gender research more broadly. Resistance to gender training is part of the contestation that accompanies change (Lombardo and Mergaert 2016), and such debates should become part and parcel of the training content in order to promote more appreciation and understanding across disciplines, as well as mutual respect. The interdisciplinarity pillar maps to the *knowledge*, *desire*, and *abilities* dimensions of the KDA framework. Interdisciplinarity is built into all aspects of the GREAT model. In our training curriculum, we impart: the *knowledge* of the concept of interdisciplinarity and the validity of disciplinary methods and approaches (see Figure 3); the value of interdisciplinary research throughout the entire research process, to build the *desire* of biophysical scientists and social scientists to work together throughout the research cycle; and applied training on gender research methods that build the *ability* of teams to integrate these findings into their work. Participants apply, attend, and complete GREAT training as interdisciplinary teams, making this a non-negotiable element of attendance.

Applied learning

Applied learning puts education to practical use, through experiential, contextualized, and personalized learning (Ovenden-Hope and Blandford 2017). Kolb (2015) proposes the Experiential Learning Theory (ELT) as a learning cycle that involves "learning from experience", on the basis of concrete experience, reflective observation, abstract conceptualization, and active experimentation. Drawing on understandings of innovation as a

gendered construct that is both relational and contextual (Blake and Hanson 2005; Wajcman 2010), gender training for agricultural research must be firmly grounded in the disciplinary and place-based contexts of its participants. Ferguson (2019) argues for the contextual sensitivity of gender trainers in terms of the cultural, political, and sectoral contexts. Elmhirst and Resureccion (2020) describe the power of fieldwork engagement between a gender expert and biophysical scientists to shift assumptions. The applied learning pillar maps to the *knowledge* and *abilities* domains of the KDA framework. In the context of GREAT, we take a very intentional approach to balance theory and practice throughout the course, ensuring that for each topical session equal time is devoted to explaining concepts and putting these concepts into practice, building the *ability* of participants to use the gender related concepts that they have been learning. We also build a strong fieldwork component (see Figure 3), where research questions and methods developed during the course are applied in the field to participants' ongoing research projects. Each team receives technical support from field trainers – members of the GREAT training team who provide hands-on technical support to the team. The field application and technical support components of the model provide space for interdisciplinary research teams to test out what it means to work together beyond the classroom environment. A dedicated team of field trainers provide technical support and coach research teams at key stages of application: theoretical conceptualization; refining the gender research questions; developing qualitative and quantitative data collection tools; data collection; conducting a gender analysis and integrating mixed methods findings; and publication. Field trainers are matched with teams on the basis of their experiences and interests.

Enabling environment and learning communities

Communities of practice (CoPs) have been used as a means to enhance capacity development efforts for agricultural researchers (Bailey 2017). Borrowing from social learning, where groups define problems, learn, and search for solutions together (Koelen and Das 2002), GREAT seeks to spark changes in institutions through collective change. The GREAT CoP approach extends to a larger learning community across three areas: 1) including targeted course enrollment from specific institutions to create a critical mass of fellows; 2) including, where possible, leadership in training courses to create champions within the institutions; and 3) connecting fellows across courses in a professional network. To create a critical mass of fellows, priority was given to applicant teams from NARIs in Ghana, Uganda, Kenya, and Burundi. To engage leadership, we prioritized applicant teams that included senior project members as this was identified as being associated with more practice change through the MLE case studies (Travis et al., this issue). The CoP aimed at connecting fellows and trainers from different courses within a peer network, by using multidirectional communications via WhatsApp, newsletters, and symposia. This last pillar maps to the *abilities* domain of the KDA framework: building a critical mass of biophysical scientists and social scientists networked to share experience and opportunities, and to act collectively to navigate contested spaces, with the ultimate aim of triggering change in agricultural research.
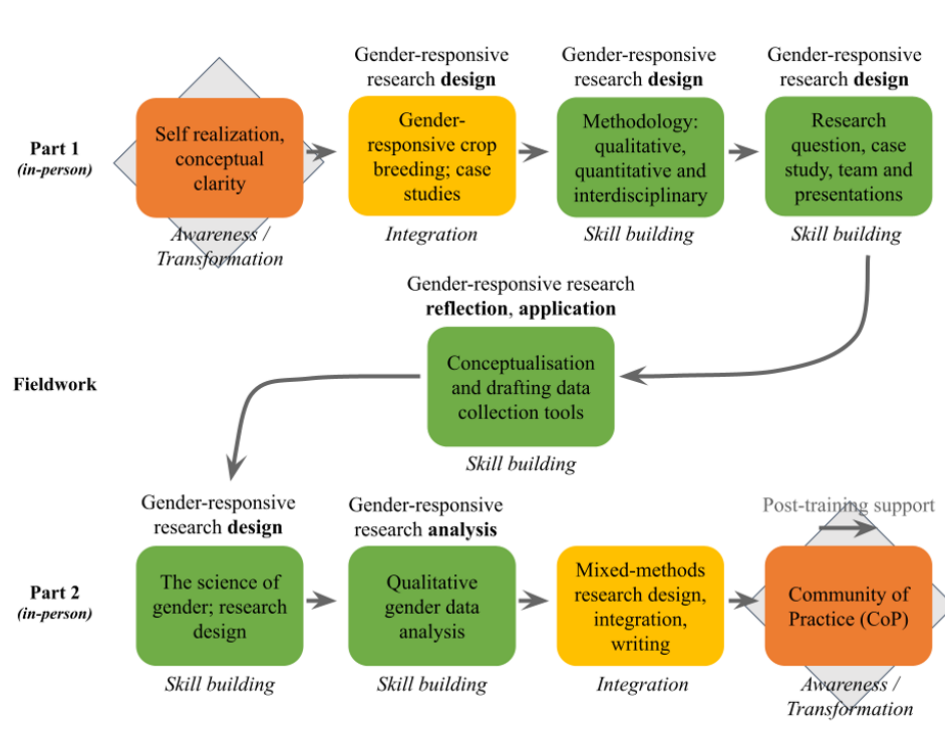
Figure 3 GREAT course roadmap. The colors are in line with the four levels defined by Njuki (2016) and presented in Figure 2.

Notes from the field: operational details of the GREAT course

In this section we outline the operational details of the GREAT course, in order to provide the reader with a complete picture of how the course was developed and implemented. These details illustrate the depth of thought and intentionality in developing GREAT and in making it fit to the two conceptual frameworks described above.

Course structure

The GREAT course consists of a sandwich model: two parts of in-person teaching, which bookend a four-month applied field training component aimed at learning through practice (see Figure 3). In the first five years, we focused on the topic of gender-responsive crop breeding. We applied rigorous and continuous review and learning opportunities throughout the development of the curriculum, course implementation, and annual reviews (see Table 1) (Travis et al., this issue). Using the skills and capacities levels outlined in Njuki (2016), the GREAT curriculum maps to all four levels:

i. *Awareness* (in orange). The first days of training explore participants' own implicit biases and positionality, providing them with the opportunity to rewire their understanding of gender issues in their personal lives and ongoing work. Also, at the end of the training, participants share experiences to influence peers, managers, and the crop breeding research ecosystem.

ii. *Integration of gender skills in crop breeding* (in yellow). The training uses examples of crop breeding in each session and focuses on teaching about cases concerned with gender issues in breeding. Training sessions in part 1 of the curriculum cover principles, tools, and methods of gender-responsive crop breeding, while sessions in part 2 focus on integrating gender research into breeding priority setting.

iii. *Building skills in gender research methods* (in green). The majority of the time in the GREAT course is spent on social science research methods. From mixed methods research design, qualitative and quantitative social research methods to drafting tools and collecting and analyzing data, participants learn how to apply these principles with a focus on how gender research informs crop breeding.

iv. *Training for transformation* (in grey). This occurs throughout the entire course, but it is particularly in focus at the start of the course – in how the course itself is framed and through sessions focused on self-reflection and conceptual clarity – and at the conclusion of the course, through intentional efforts to keep participants engaged in a community of practice after the course.

Course learning outcomes

GREAT courses are guided by the overall objective of strengthening researchers' ability to design, conduct, and communicate GRR, which feeds into five specific learning objectives for fellows: 1) the ability to articulate the concepts and principles of GRR;

2) a demonstrated positive practice and value of GRR; 3) the ability to conceptualize, design, and plan appropriate GRR; 4) the ability to collect, analyze, interpret, and integrate qualitative and quantitative sex-disaggregated data; and, 5) the ability to communicate GRR to a range of audiences in order to generate positive impacts. These course learning outcomes were developed as critical growth areas to achieve the skills and capacities levels described above and outlined in Figure 3.

The training team

To support the interdisciplinary breadth of topics covered in the courses, the GREAT training team draws from a wide set of topical expertise, centered around a core team of trainers based at Makerere University and at Cornell University. When additional expertise is needed – for instance, to design a new curriculum – guest trainers or consultants are brought in to develop the mate-

MLE Component	Lead	Period	Timing	Method(s)	Notes
In-Course MLE					
Mainstream course MLE	Aline Impact, Ltd	2016-20	At the end of each course part	Course evaluations; key informant interviews; course observations	MLE sought to assess changes in attitudes, knowledge and skills, and competencies of the fellows. Data was collected through an end of course evaluation and key informant interviews. At the end of week 1 and week 2 of the training, fellows were asked to complete course evaluation forms and to provide feedback on their learning and satisfaction with the training course. The course evaluation form was administered to all fellows present on the final day of the training.
Participant technical assessments	Cultural Practice, LLC / Aline Impact, Ltd / GREAT Project Management Team	2016-20	Pre- and post-course	Participant technical assessments using online forms	Administered for all courses using online survey tools (Qualtrics / Survey Monkey), using multiple choice questions (with some open-ended responses used in the assessment for the first course). Length varied from 16 questions for the first course, to 45 questions for courses 2-4.
Trainers' debriefings	GREAT Project Management Team	2016-20	Daily	Mixed (see Notes)	Trainers' debriefs occurred at the end of each course session day. During the first course (2016-2017), the entire training team met at the end of each day for lengthy discussions (1-2 hours) of the day's sessions. For courses 2-4, trainers used sticky notes to track pros, cons, and changes for each session, with a brief review (10 minutes) of all comments.
Post-Course MLE					
Outcome monitoring	Aline Impact, Ltd	2017-20	Annually, in Sep. / Oct.	Online survey; follow-up questions; document review	Assesses how the change in attitudes, knowledge, skills, and abilities is translated into more effective gender-responsive actions and research practices in projects and institutional level outcomes. Careful attention was paid to qualitative question design to ensure that the collected data was verifiable and consisted not only of fellows' perceptions, but it also elicited detailed information and included specific examples of change, which could help to contextualize the quantitative responses.
Case studies	Aline Impact, Ltd	2019-20	One-time study	Key informant interviews; focus group discussions; observations during field visits; document review	The case studies were selected from participating teams in course 1 (Root, tubers, and bananas) and course 2 (Cereals) to ensure sufficient time for learnings to be applied, and possible benefits to materialize or to be analyzed and interpreted. The case studies analyzed what the Fellow teams were able to accomplish as a unit by examining their GREAT-associated research. Moreover, case studies also reviewed subsequent research materials shared with the evaluation team and considered individual impacts as well as explored dynamics between cohorts (i.e., the impact of multiple teams trained from the same institutes or programs). Across the case studies, data was collected through key informant interviews with fellows, other research colleagues, supervisors, implementing partners, and farmers. These were complemented with focus group discussions, observations during field visits, and extensive document reviews.
Spin-off course MLE	Aline Impact, Ltd	2018-20	One-time study	Online survey; document review; key informant interviews	Qualitative questions were carefully formulated to ensure that the data collected could be verified and included fellows' perceptions, complemented with more information and specific examples of change to contextualize quantitative responses. A document review was carried out to evaluate relevant training materials and samples of training participant work, where available. Key informants were selected in consultation with client focal points and care was taken to capture a cross-section of participants from different countries, disciplines, seniority, participating institutes, and genders.

Table   1 GREAT project monitoring, learning, and evaluation (MLE) approaches.

rial and to guide the core training team in developing these new proficiencies, enabling the core training team to directly incorporate this capacity.[3] The anchoring of the training team in Makerere University ensures the institutionalization and continuity of the course, while continuous reflection on the skills and capacity levels outlined above to recruit additional trainers further strengthens the GREAT model. A competency framework described by Mangheni et al. (this issue) outlines competency domains and trainer assessment tools to guide trainer recruitment, evaluate their performance, and identify competency gaps for further capacity development.

Participant recruitment

Between 2015 and 2020, we trained 240 researchers from 26 countries through four mainstream courses and four spin-off courses – shorter, on-demand courses complemented with some projects.[4] The vast majority of participants came from SSA and worked at NARIs, while fewer participants came from the CGIAR (formerly the Consultative Group for International Agricultural Research). The four mainstream courses were delivered along the following thematic areas: gender-responsive root, tuber, and banana (RTB) breeding (course 1); gender-responsive cereal grain breeding (course 2); gender-responsive legume breeding (course 3); and gender-responsive crop breeding (course 4). See Appendix 1 and Appendix 2 for details on all courses. Applicants were required to apply as interdisciplinary teams with two or three fields of expertise, including crop-improvement related biophysical science (e.g., crop breeding, plant pathology) and social sciences (e.g., gender, agricultural economics, rural sociology), and were selected after a holistic review process, centered on the following criteria: likelihood of the training to significantly impact their careers/work; likelihood of the applicants to influence their peers and impact the future of their institutions; a clearly discernible gender dimension to their research; the potential for positive impacts on women and girls through project outputs and activities; and likelihood of the team to transform the learning material into positive impact.

Financing participation and course sustainability

GREAT was conceptualized as a fee-paying course, and the project design anticipated that participants' ability to pay for the course would increase alongside its demand as the course became more established. Grant funding for direct course support was expected to diminish over time. Looking across the courses, the percentage of participants from fully fee-paying teams increased steadily from 19 percent in course 1 to 50 percent in course 4. Over time, we realized that many of our original assumptions proved untenable.[5] A commissioned study found that course fees were higher than other gender training courses. Transportation costs were also high as participants had to travel twice to Kampala (to attend part 1 and 2 of the course), which, together with lodging, accounted for approximately two-third of the course costs and was above what most NARI participants could afford. Without dedicated funding to support NARI participants, this training model would be financially unsustainable. To address

this issue, we tested alternative models: regional training; a single-phase course model (eliminating the field research); online delivery of parts of the teaching; and reduction of the overall course length.[6]

Results – GREAT phase I (2016-2021)

The results in this section draw on data from a broad range of sources, including substantial in-course and post-course MLE data collected over five years. Table 1 summarizes the data sources. Details on the data collection methods for these results are presented in Travis et al. (this issue). In the following, we introduce the results on the general appreciation of the GREAT course and its application over time, followed by a reflection on how the results reflect each pillar of the course using the KDA framework (Ferguson 2019) and the capacity levels described by Njuki (2016).

Fellows demonstrated clear appreciation of the overall GREAT learning model and of its three-part structure. In post-course evaluations of courses 1–4, average levels of satisfaction were 3.5 for the overall GREAT model, 3.7 for the content of part 1, 3.6 for the content of part 2, and 3.3 for the fieldwork process – where 4 indicated extremely satisfied, 3 satisfied, 2 partly satisfied, and 1 not satisfied at all. GREAT's fellows were surveyed annually to assess how the change in knowledge, attitudes, and skills translated into more effective gender-responsive actions and research practices in projects and institutional level outcomes. Careful attention was paid to ensure that the collected data were verifiable and consisted not only of fellows' perceptions, but they also included detailed information and specific examples of change which could help to better contextualize the quantitative data. Fellows self-reported high levels of application of the learning material of the course to their work. The results, summarized in Figure 4, show an increasing in application within one year after fellows' participation in one of the GREAT courses. Prior to taking part into the GREAT course, 10 percent of participants reported applying GRR at high or very high levels[7]; this number increases to 69 percent after four years.
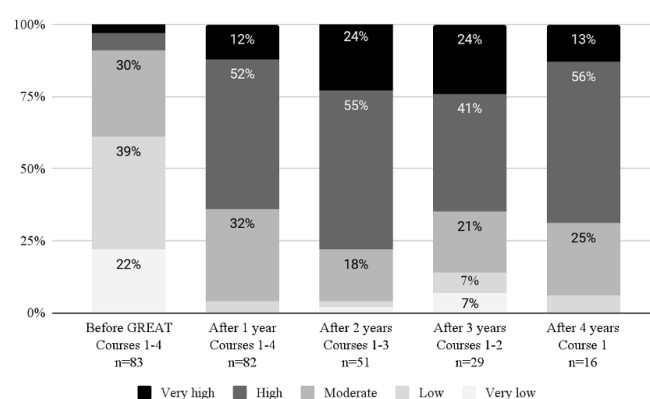

Figure 4 Fellows' self-reported application of GRR over time. *(Source: Aline Annual Outcome Surveys (OS), 2018-2020, Aline Impact, LLC, unpublished.)*
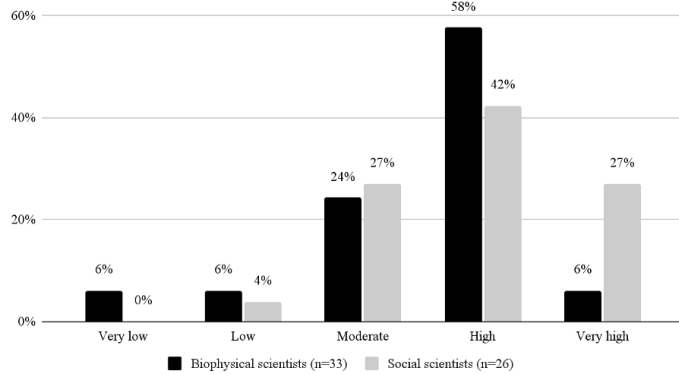
Figure 5 GRR application by discipline, courses 1-4. *(Source: Aline Annual Outcome Surveys (OS), 2020, Aline Impact, LLC, unpublished.)*

Figure 6 Distribution of fellows' self-reported satisfaction with changes in their attitudes toward GRR. *(Source: GREAT course MLE reports, Aline Impact, LLC, unpublished.)*

This self-reported shift in application of GRR extends across disciplines, with a greater proportion of social scientists reporting very high levels of application. Data from the 2020 outcome survey show that 88 percent of biophysical scientists (n=33) and 96 percent of social scientists (n=26) reported moderate, high, or very high levels of application, with 27 percent of social scientists reporting very high levels of application compared to 6 percent of biophysical scientists (see Figure 5).

Self-reflection: shifting biases and beliefs

The central focus of the GREAT model on framing learning around self-reflection had substantial impacts on participants' gender biases and beliefs and its importance to their lives and work, resulting in deeper understanding of gender concepts and greater appreciation of its value to their work. According to the MLE case study report, many fellows and their supervisors (who were interviewed to triangulate the self-reported results of the fellows) stated that their own understandings and perspectives on GRR and its importance fundamentally changed after participating in the GREAT course. In end-of-course evaluations, participants were asked to determine the extent to which the course had changed their attitudes with respect to GRR. An overwhelming majority of participants reported they were extremely satisfied with the extent to which their attitudes had changed (see Figure 6; note that the question was not asked to the participants of course 1).

Reflecting on the main reasons driving these attitudinal shifts, the course 4 MLE report notes that fellows cited both a deeper understanding of gender concepts and GRR as well as a greater appreciation of its value to their work, which were also cited as key reasons by participants of all the previous courses. The top-two rated competencies in the immediate post-course proficiency across 17 competencies, were: "ability to appreciate the usefulness of gender-focused research in your work" and "motivated and self-driven to integrate gender issues into your research work".
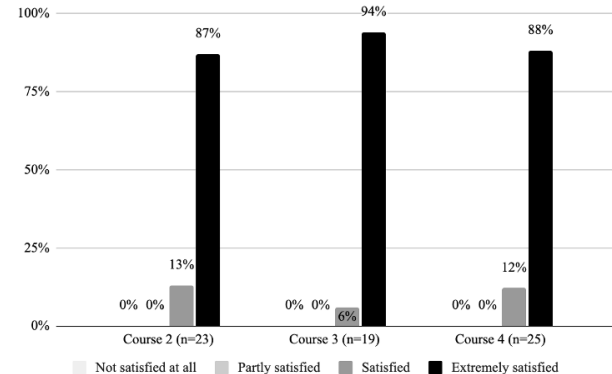
This change seems to have lasted long after the end of the courses. The MLE case study syntheses, conducted two and three years respectively after the second and first courses ended, noted that: "Across all [six] case studies, fellows exemplified a continued interest and enthusiasm for advancing gender-responsive research several years after the course concluded, noting fundamental shifts in how they understood and considered gender [issues]." The impact was especially noticeable for biophysical scientists, especially crop breeders.

Shifting awareness and motivation appears to lay the foundation for broader changes in research conceptualization and practice:

> The concept of gender itself is something which was not clear to me, and I used to associate it with women['s] activism. . . . To me as a statistician and a research methods specialist, understanding gender becomes very handy for me, because I am [now] able to understand what they are talking about and help them more, because sometimes people think they have a statistical problem, but they actually have a problem with conceptualizing their studies.
> (Interview, male biostatistician and project leader, course 2)

The foundational focus of the GREAT model on challenging gender biases and beliefs helped fellows not only to see the limitations of their prior knowledge and beliefs, but also to create conceptual linkages between gender theory and the development outcomes of their crop breeding work. Fellows widely acknowledged a significant deficit in their understanding of gender concepts and of the importance of addressing gender issues in order to achieve more effective and equitable development outcomes. This was particularly evident among breeders, yet even social scientists working on gender issues recognized the necessity of a more comprehensive understanding of what it means to address gender-related concerns in their research. Changes in biases and beliefs map to Njuki's (2016) level 1, awareness skills and capacity, and to the KDA's *knowledge* domain. The course also resulted in increased motivation for changing practices for

both social scientists and biophysical scientists, which maps to Njuki's (2016) level 4, transformative training potential, and to the KDA's *desire* domain. Most importantly, it appears that these shifts were maintained over time and linked to the space and time dedicated to understanding gender biases throughout the GREAT courses.

Interdisciplinarity: learning to value working together

The focus on interdisciplinarity had significant impacts on participants' awareness, motivation, and abilities to work together across disciplinary divides. According to the case study synthesis report, participation in GREAT heightened the importance of forming interdisciplinary teams, including both biophysical scientists and social scientists. Moreover, fellows broadly discussed a shift away from thinking about gender issues as an afterthought and, instead, they pointed to the importance of considering gender issues at the outset of a project. This finding was mirrored in the outcome monitoring results.

Greater incorporation of social science into the entire research process was partly achieved by the development of a common foundation for further collaboration during the GREAT courses. This foundation helped to increase the collaboration between social scientists and biophysical scientists and to reduce conflicts between researchers on how and when to include gender issues and social science in research projects:

> *Working with breeders who have also gone through the GREAT training...before discussion on gender would be hot with a lot of disagreement, but now biophysical scientists have enrolled into the course and have applied the knowledge. When you talk about gender it's no-longer a new thing or something to be opposed [to].*
> (Interview, female crop breeder with gender training, course 1)

The learning goes in both directions, with one socio-economist discussing how her collaboration with the breeders enabled her to identify a significant information gap among women farmers that was limiting the adoption of crop varieties. She credits realizing the value of such collaboration to GREAT:

> *[I now recognize] that it's really important to work in interdisciplinary teams. It helped to understand what the breeders were trying to achieve and also making them understand my work as a value chain economist and gender focal person, hence better collaboration.*
> (Interview, female socio-economist and gender focal person, course 2)

That such interdisciplinary collaboration is not the norm in many research institutions is underscored by the senior institutional leader of the team:

> *This was an opportunity to have two people on a test case where a social scientist and biophysical scientist working together closely on a joint project – this is not happening necessarily so naturally, and I think this is really a good experiment.*
> (Interview, male institutional leader, course 2)

Change does not come easily, and it requires to challenge disciplinary orthodoxy and commonly held views, beliefs, and practices:

> *In the variety testing process, I realized that there were some traits that I had underlooked [sic], such as sweetness, cookability, and reticulation. So now I go a lot with the socio-economist to the community when I'm going to collect data, we establish what the men say about the test lines/varieties and what the women say about it. In that way I feel we are not leaving anybody out. Sometimes my other breeders tell me: "You man, you are going into the social sciences and leaving the genetic stuff", but I say: "No, we need to make sure that the technology we come up with is easily adopted by everybody, then we have to get the actual story from the men, from the women and from the youth altogether". So, that is how I'm now operating even in other breeding projects.*
> (Interview, male crop breeder, TLIII spin-off)

In five out of six case studies, social scientists described improved confidence and authority, as well as greater demand for their work within other research projects:

> *GREAT increased my confidence to engage with biophysical scientists and tell them that [they] can collaborate and there is more ground we can cover together....There is a lot of demand for my services now.*
> (Interview, female socio-economist and gender focal person, course 1)

The changes in interdisciplinarity observed relate to the *knowledge*, *desire*, and *abilities* dimensions of the KDA framework. By raising awareness (*knowledge*) amongst biophysical scientists of the value that social scientists can contribute to research as well as the *desire* for the benefits such collaboration can offer, the interdisciplinary focus of the GREAT courses can foster more opportunities and agency for social scientists. These improvements were further supported by a shift in the *ability* to operationalize GRR, resulting in greater efforts to engage men and women in the research process. These results correspond to the capacity and skill development of the levels 2 to 4 of the Njuki's framework, demonstrating that not only did the teams learn to apply gender research skills, but they also integrated them in gender-responsive interventions. These results, however, come with a caveat: MLE data show that while changes in practice were significant in many cases, they were piecemeal and depended on contextual factors, such as institutional arrangements, that, in many instances, were outside of GREAT's direct sphere of influence.

Applied learning: the power of connecting theory to practice

Applied learning in the GREAT model encompasses three elements: 1) grounding theoretical sessions in practical examples (e.g., case studies); 2) field application (see Figure 3); and 3) technical support by dedicated field trainers. Case studies are integrated into all the course sessions, providing practical illustrations of how to apply gender theory to real-world settings. These case studies also connect different course sessions, helping to build concepts in a stepwise fashion. We do not, however, have MLE data on the efficacy of this approach. The fieldwork in the GREAT courses was evaluated by fellows and played a fundamental role in connecting theory to practice, enabling biophysical researchers to see gender research in a new light. The majority of the course participants reported being either satisfied or extremely satisfied with the field research phase of the course (see Figure 7).

The combination of gender theory and practical application was praised by participants for its ability to provide a helpful framework to both understand the importance of gender research as well as to be equipped with the appropriate tools to then implement such research:

> GREAT has been a great experience: I was exposed to gender concept[s] and gained [a] better understanding that it's not about women or sex. We did not learn the concepts and theories just to go to sleep with [them], rather we used them to guide development of the fieldwork proposal and we went to the field to collect data. I had never done such social research before, and I used to think that social science research was just about theories and information which cannot be analyzed. But this training was very practical, and it changed my understanding. Undertaking the fieldwork enhanced my appreciation of the importance of talking to real farmers to be able to capture the views and needs of both men and women. GREAT enabled me to see how to relate the socio-economic aspects and issues in the context and how they influence men and women, to the work we are doing as breeders to make the research more relevant to the target groups. I learnt how to integrate gender in breeding programs.
> (Interview, male biophysical scientist, course 4)

Fieldwork allowed participants to experience the rigor and practical challenges that underlie good qualitative and quantitative gender research, instructing them on the value of interdisciplinarity and creating opportunities for learning that could be plugged back into their other work and institutions. Testing tools and carrying out data analysis in the context of their projects and with the technical guidance of field trainers catalyzed a deeper retention of knowledge and ability. This helped to concretize theory for participants who had never been involved in farmer-level data collection.

Technical support by field trainers is a key part of the GREAT model and yielded clear benefits. Teams that made use of the technical support had higher-quality data and analyses, helping to ensure that concepts and tools were used in an appropriate manner. Where the technical support was active, fellows noted significant benefits and were able to undertake corrective action. Field trainers especially helped participants with no field experience to navigate the collection of sex-disaggregated data, conduct focus group discussions or key informant interviews, record verbatim transcripts, or even simply go into communities to speak with farmers. Where field trainers were not present in the country of the participants, native language support was not available, or teams did not engage field trainers in a timely manner, participants could not effectively capitalize on field trainers' expertise. Where the technical support was not utilized, there were notable deficiencies with respect to the teams' learning and capacities, especially in the data analysis.

The findings generated through fellows' fieldwork helped to catalyze shifts within their own research projects. Teams that were particularly successful at replicating gender-responsive practices and at using findings to inform changes in their breeding programs point to how the information and learning derived from the GREAT course was timely and relevant to their work:

> At the time of participating in GREAT, we had several hybrids under evaluation through multi-location trials. The idea was to incorporate gender during the participatory variety selection (PVS), but I had not done anything [like that] before GREAT. So, participation in GREAT was very timely as the knowledge informed [the] integration of gender in the PVS.
> (Interview, female crop breeder, course 2)

For a project in the final year of its implementation at the time of the GREAT training, insights from the course and the field research helped to inform participants' approach in writing an extension grant. Teams who were in later stages of their projects with limited new research prospects in the pipeline were less able to replicate gender-responsive practices to their breeding programs. Instead, fellows reported that they put efforts into finalizing their research in the form of manuscripts and integrating gender issues into their new proposals.
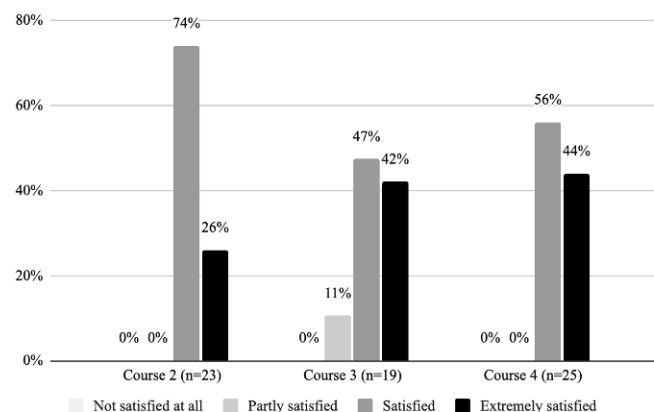

Figure 7 Distribution of fellows self-reported satisfaction with the field research phase of the course. *(Source: GREAT course MLE reports, Aline Impact, LLC, unpublished.)*

Applied learning played a key role in enabling participants to translate their *knowledge* and *desire* into *abilities*. Indeed, applied learning provided greater accuracy in participants' use of methods, concepts, and tools and it helped them to build confidence as they navigated new terrains both as individuals and as interdisciplinary teams. These outcomes mapped to levels 2 and 3 of skills and capabilities (Njuki 2016), since fellows learned how to conduct high quality GRR and integrate this into their ongoing research projects.

Enabling environment and learning communities

Fellows working in the same program and on the same projects increased their opportunities of applying GRR by developing a widespread appreciation of its importance and by sharing knowledge and responsibilities through social learning. Fellows also pointed at increased collaboration across cohorts by visiting sites, sharing learning and insights across projects, and, in several cases, collaborating on new projects. Fellows noted that working with a team that understood and appreciated gender research enhanced teamwork. This provides a strong foundation for interdisciplinary GRR and contributes to the envisioned model of building critical capacity within research institutes in order to ultimately change the practices of research teams.

> *Our institution has greatly benefited from the knowledge acquired by the team. For any organization/institution or program, success greatly depends on the caliber of human resources that you have. Now, having staff that are knowledgeable in gender-responsive research (GRR) has increased our capacity to apply GRR.*
> (Interview, male crop breeder and project leadership, course 1)

This increased capacity resulted in a greater focus on gender data and research questions in the development of research proposals, cross-collaboration between cohorts, integration of gender in programs' activities, data collection, and analysis. Such changes have not been lost by institutional leaders:

> *[A] big difference has been in the number of people with the capacity to do the gender work. The skills to undertake the work with a gender focus and ensure sex disaggregation. The number of people who are gender sensitive has increased in [our institution]. The number of people who are aware of gender increased in the root crops program and beans program. We have also used them to support work on gender in other projects within the programs....There is a difference with regards to the focus on gender in research design and data collection. There is emphasis on collection of sex-disaggregated data now.*
> (Interview, male institutional leader, not a participant of GREAT)

Two of the higher performing teams both included senior researchers who were in a position to shape and influence the direction of their research institutes. Other teams also noted that while their application of GRR practices may have been constrained by a lack of resources, having supportive supervisors was critical to what they were able to achieve:

> *The most decisive factor will undoubtedly have been the fact that the person who led the project was very sensitive on the issue [of gender]; he is considered to be a specialist in the same way as the focal point of gender at the level of our institution.*
> (Interview, male institutional research director, not a participant of GREAT)

Importantly, involving leadership also sends a strong message, since it normalizes the importance of GRR, helping others, including fellows, to feel justified and safe in advocating for a shift in thinking and practice and enabling them to both instruct staff on the need for its inclusion as well as to direct resources and activities accordingly:

> *And other researchers have seen that finally gender is serious since [the program leader] also believes in it and participates in it. Otherwise, before they thought [that] these are theoretical stories of women. After it gave me the opportunity to raise awareness of gender.*
> (Interview, female gender focal point, course 1)

For teams without supportive leadership, change was more difficult. In one institution, fellows had participated in each of the first three GREAT courses, and while some practice changes had been evident, fellows pointed to a lack of understanding or appreciation by other researchers and administrators in the institution of the importance of addressing gender issues.

Institutional environment, gender policies, and resource allocation to carry out research played key roles in shaping the extent to which fellows were able to apply the knowledge acquired during the GREAT course. In each of the six case studies, there were variations in terms of the institutional gender policies in existence, yet researchers pointed at a lack of contextual specificity to functionally guide application in their research. The existence of such policies and guidelines created an important incentive for gender issues to be considered, but GRR was only carried out where there was institutional support and dedicated resources to do so. To overcome resource shortages, GREAT allocated seed grants during the field training portion of the course, which enabled teams to carry out the data collection, analysis, and reporting. For better resourced institutions, the seed grants helped the institutes to match funds and to further invest in the collection and implementation of GRR that had not originally been planned for. This appeared to have engendered budgeting shifts, with several teams pointing at new projects and studies in which gender-related activities had been budgeted.

Virtually connecting fellows from different institutions through a CoP also yielded significant benefits. 95 percent of fellows found their engagement in the GREAT CoP to be either useful or very useful (see Figure 8). Resources and information shared through emails, newsletters, and resource sharing platforms (such as resource hubs, WhatsApp, and newsletters) were cited as important sources for accessing reference materials, facilitating connections to other projects, and helping to form new collaborations, proposals, and career opportunities (see Figure 9).
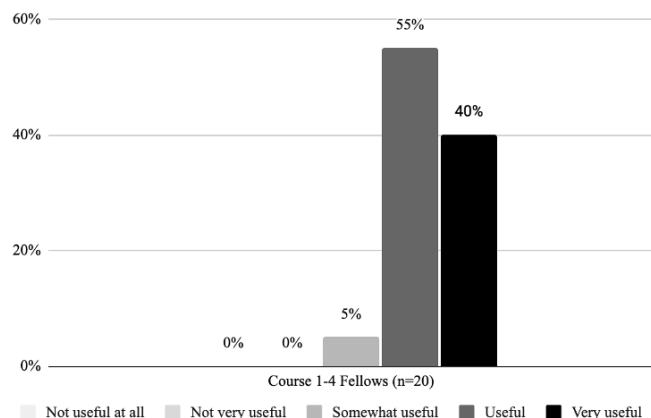
Figure 8 Fellows' views on the usefulness of the GREAT CoP. *(Source: 2020 Outcome Survey, Aline Impact, LLC, unpublished.)*

Figure 9 Types of benefits that fellows report from their engagement with the GREAT CoP (n=20). *(Source: 2020 Outcome Survey, Aline Impact, LLC, unpublished.)*

This sort of networking enabled fellows to tap into technical knowledge and support, further develop their skills, and identify opportunities for career advancement.

> *Networks made during GREAT training connected me to other projects where I was engaged as a research assistant and further practiced. From GREAT, I learnt how to collect and analyze qualitative data and this has opened up opportunities to participate in [new] projects. People with qualitative studies do trust me to collect quality qualitative data. For instance, I was connected to [a] project based at [the college], where I collected data on youth unemployment and managed the database, and [I] also learnt data collection using photo voice. Through these connections, I also participated in a study on gender and land for [an external organization]; [I] was part of the team that collected gender data in western Uganda on another project and [I] also collected data on gender and response[s] to climate change in [two regions of our country] in another project. All these have been qualitative studies involving FGDs [focus group discussions] and individual interviews.*
> (Interview, female social scientist, course 2)

Fellows' research practices exist within the context of the cultural norms and practices of their research projects and institutions, so to trigger changes in their research practices they will need to challenge the established norms surrounding these practices. This is primarily an *ability* domain, in so much as it involves operationalizing learning, but it also depends heavily on having the confidence to challenge the status quo – which is predicated on the motivation (*desire*) to affect change and on the awareness (*knowledge*) of what needs to be changed. The self-reflection and interdisciplinarity components of the GREAT course also feed into this: indeed, self-reflection increases awareness (*knowledge*), while interdisciplinarity builds relationships and abilities needed to challenge dogmatic practices across disciplines. All of this amounts to building strong and supporting networks that fellows can fall back on and tap into, creating new, gender-responsive norms and practices that can be fruitfully applied to their
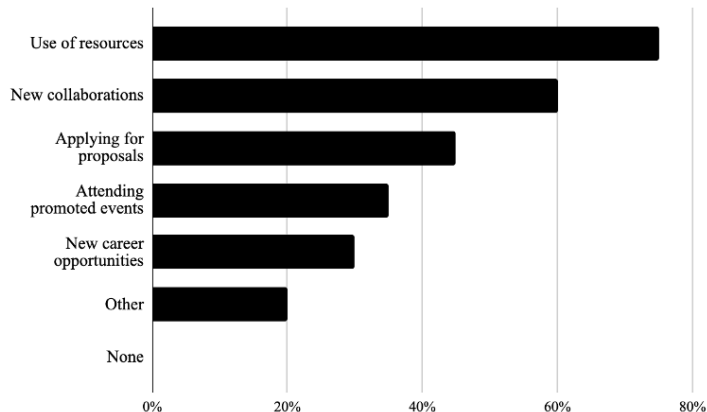
institutions and projects. This collective action maps to Njuki's level 4, skills and capacities, where researchers, once having reached a critical mass, are striving for transformative change.

Discussion

GREAT successes

The GREAT journey began with a need: failing to identify applied gender training programs for agricultural researchers, we explored what an ideal course could look like. Five years after, we reflect on our results. Drawing from Ferguson (2019), we conclude that GREAT has demonstrated the qualities of a feminist gender training program for effective social change, awakening fellows' knowledge of the desired change for gender equality, the desire to make such change possible, and the ability to articulate, reflect, and communicate that change. GREAT courses deliver all four levels of skills and capacities needed for a gender transformative, feminist training for agricultural researchers (Njuki 2016). Coming back to our original research question – what are key aspects of a gender training program that seed attitudinal shifts and practice change in agricultural research teams? – we demonstrated that the four key pillars that underpin GREAT training (i.e., self-reflection, interdisciplinarity, applied learning, and, enabling environment and learning community) do seed attitudinal shifts and practice change. After five years and building on these four foundational pillars, GREAT has evolved towards "transformative gender training" that is reflexive, self-critical, and focused on process (Ferguson 2018).

We have conceptualized, tested, and refined our curriculum through continuous improvement, innovating and learning to reach an optimal balance (see Mangheni et al. and Travis et al., this issue). Appendix 3 illustrates key correction points in our curriculum. The resulting curriculum balances content, length,

and flow with feminist and participatory pedagogical delivery approaches. Balancing theory and practice, interdisciplinarity and applied learning, self-reflection and action, participants contribute to shaping a learning journey that iteratively and reflexively builds skills, capacities, and mindset change. Interestingly, we have not experienced much resistance from participants as compared to what is reported in other contexts (see, for instance, Lombardo and Mergaert 2016). This is likely due to the course format, flow, and content. Further, our program is external to participants' home institutions and led by two universities. This can add credibility to the trainers' abilities and decrease the feeling that the gender training is top-down or mandated. In addition, participants applying to GREAT are competitively selected and may already be interested in changing and making a change when it comes to gender inequalities.

The impact of GREAT during its first five years has been on the narrow research ecosystem of crop improvement. We created a tailored course for crop improvement, combining applied examples and learning from real life projects, achieving the very important criteria of developing appropriate specialist knowledge, experience, and skills that are important for effective gender training (Ferguson 2018). Building a critical mass of crop breeding researchers, who are passionate, dedicated, and curious of making a positive change towards achieving gender equality goals is an important result. Increasing gender "fluency" (Wong et al. 2016) in crop improvement is the first basic step, yet GREAT clearly goes beyond sensitization and fluency. Prugl (2016) outlines key ethical principles for gender training: rational deliberation across difference, non-cohesion and equality, inclusiveness of diverse knowledge and participation, and reflexivity. GREAT training mostly meets these principles, instructing breeding teams on the importance of placing gender issues at the heart of the design of crop breeding innovations and of carefully examining "how the world we live in is shaped, and for whom" (Wajcman 2010, 151), openly avoiding reductionist short training events (Mukhopadhyay 2014). However, developing a curriculum that appeals to and fits the needs of both biophysical scientists and social scientists can limit the depth of the material presented, since this material needs to be mainstreamed for a larger audience. To circumvent this problem, GREAT adapted its curriculum by adding additional days of training for social scientists, during which specific material, which was not relevant to biophysical scientists, was presented. This helped to identify some of the challenging norms and behaviors that perpetuate gender inequality in the conceptualization and practice of crop improvement

A long-lasting legacy of GREAT will be the institutionalization of the program at Makerere University. This would mean approval of the course by the formal university structures such that it continues to be offered beyond project funding. Our strategy of building a leadership and team of trainers at Makerere University, who could lead curricula design and delivery, avoided the perpetuation of hierarchies of feminist knowledge transfer that only values the authority of "international gender experts and western feminist knowledge" (Kunz 2016). Furthermore, the Makerere team of trainers is composed of permanent faculty members with interdisciplinary expertise who can continue

to train the next generation of gender-responsive researchers in agricultural research and extension. While some of the original content of the course was developed or sourced from westerners, this team has developed the bulk of the content and adapted externally developed material to the context of the African continent. Lastly, the close relationships between faculty from the College of Agriculture and Life Sciences and the School of Women and Gender Studies opens up new possibilities for interdisciplinary collaboration and institutional change.

GREAT learning

A limitation throughout the program has been the difficulty of collecting relevant data to demonstrate long lasting, tangible practice change in participating fellows, their research, and their institutions. In a formative process of adaptation and evolution that had multiple changes enacted at each course, and on a short time scale, collecting data to demonstrate GREAT's direct impact was a challenge (see Travis et al. this issue). A major learning was that practice change from GREAT training when it can be traced, was piecemeal and dependent on institutional factors that were outside of GREAT's engagement. This speaks to the limitation on what can be achieved with individual or team gender capacity development alone, in absence of institutional support, facing resource scarcity in NAREs to support fellows for a paid course and lack of formative training during degree programs. Clearly our claims around the transformative potential of GREAT will only be realized if going forward the program is paired with more holistic interventions at the institutional level and integrated into graduate training curriculum for agricultural research scientists.

Throughout these five years, we have learned and continue to learn important lessons. There is a fine line between building the confidence of social scientists in engaging in GRR and conflating gender-focused research and social science. We remain vigilant and reflective of this, always taking into account the importance of working with gender specialists. In training, we emphasize the relevance of engaging qualified gender specialists to help to shape and implement gender research related to crop breeding, building on the GREAT sessions on "The Science of Gender" and on gender research methods.

Ferguson (2015) asks: "Despite the high quantity and quality of gender experts, why does such work often go to those with no training or experience in gender?". In GREAT training, we have learned that this remains a pitfall which we need to spend time openly reflecting on, without weakening participants' desire for change. This is an area we still need to work on, as we see fellows with no prior gender research experience coming out of GREAT courses and ascribing to themselves the title of gender experts. This risk is especially present among social scientists who often view gender research as a simple methodological add-on, failing to deeply engage in self-reflection and scrutinize their theoretical foundations. This carries the risk of crossing "[t]he fine line between 'doing gender' and doing more harm than good" (Ferguson 2015). Reflecting on some of the quotes presented above, we also observe that GREAT fellows are complicit in interrupting the formative close relationship between gender and feminism

(Mukhopadhyay 2014). Fellows recount that before the course they saw gender as "women['s] activism" or something "to be opposed to" or "theoretical stories of women", testifying that this is no longer the case after their participation in the course. Here, we are subject to feminist critiques of gender training, where the intent of transforming oppressive systems is replaced with safe conceptualizations of gender equality. We also observe that gender training becomes a marketable skill with fellows stating that the demand for their services increased after their participation in the GREAT course. This puts into question participants' motivations for attending the GREAT courses, casting doubts on whether fellows are truly motivated by the desire to trigger gender transformative change or they are simply interested in learning how to do gender.

We have also learned the limitations of the quality of gender research we can expect from the field application phase of GREAT. The learning curve of the course is gradual. There is evident progress in the collection and analysis of sex-disaggregated data, including the appreciation of qualitative data. That said, most of the research carried out during the trainings and supported by GREAT still falls short of good quality gender research and it rarely addresses intersectionality. This is in line with the broader ecosystem, where research that "moves beyond the women-men binary is woefully lacking in gender and agriculture studies" (Tickamyer and Sexsmith 2019). This is not unexpected from researchers with no experience in social science, qualitative data collection and analysis, let alone gender research. Nevertheless, we are falling short of making meaningful contributions to gender equality by changing norms and practice in agricultural research if our work perpetuates oversimplified binary comparisons of men and women.

In contrast to the points raised above, GREAT courses may also build bridges and push the limits of the validity of "gender knowledge." As Ferguson (2015, 386) so eloquently puts it:

> How can we make a claim that someone else's knowledge on gender is wrong – that is, not feminist – and therefore not a true gender approach? Are we saying that only feminists can have gender expertise and knowledge? What, if anything, do we gain for our profession by doing so?

Conversations about participants' experiences, perceptions, biases, and beliefs during the first days of the course, open the door to change through empathy and understanding. As with any capacity development project, our ability to track longitudinal practice change for fellows is very limited, and we mostly rely on self-reported data (Travis et al., this issue). The GREAT CoP allows us to continue to observe our fellows' contributions to research once they have concluded the course. We see from many fellows a sustained engagement with gender issues in their work. However, the extent to which this contributes to changing institutions and achieving inclusive development goals is less clear. Participation and interest in gender research may be the result of a changing international development context (e.g., donor demands and government policies) and a renewed commitment to gender equality and women's empowerment. This is potentially problematic since what fellows deem as shifting attitudes, knowledge, and skills may still fall short of change in day-to-day

research practice or in broader institutional and development contexts.

Conclusion

The true impact of GREAT heavily lies in its capacity to build transdisciplinary crop breeding teams, who work together to shape GRR with a breeding lens as well as breeding with a gender lens. This paper documents how GREAT has made progress towards these goals. As we conclude the first phase of GREAT, we do so by looking forward to addressing some of the gaps identified in this paper. We continue to test cost-effective models and to check which elements of the GREAT course are essential for attitudinal and practice changes. An advanced training course has just been piloted, where significant time is allocated to exploring feminist theories and their application to agricultural research, deepening concepts of intersectionality, masculinity, and women's empowerment, with additional sessions on MLE and effective communication for change. We are also testing models of pairing this advanced learning with collaborative research engagements, in order to further the experiential and social learning of GREAT. Finally, as the program tests new geographical adaptations beyond SSA, we remain optimistic that GREAT fellows will influence the broader institutional environment within which agricultural research operates.

References

Ahikire, J. (2007) 'Gender training and the politics of mainstreaming in post-Beijing Uganda,' in Mukhopadhyay, M. and Wong, F. (eds.) *Revisiting gender training: the making and remaking of gender knowledge*. Amsterdam, NL: KIT (Royal Tropical Institute), pp. 39–46.

Bailey, A. (2017) 'Can CoP theory be applied? Exploring praxis in a Community of Practice on gender', *Knowledge Management for Development Journal*, 13(3), pp. 60–76.

Blake, M.K. and Hanson, S. (2005) 'Rethinking innovation: context and gender', *Environment and Planning A*, 37(4), pp. 681–701.

Chant, S. (2012) 'The disappearing of "smart economics"? The World Development Report 2012 on Gender Equality: some concerns about the preparatory process and the prospects for paradigm change.' *Global Social Policy*, 12, pp. 198–218.

Cornwall, A. and Rivas, A.M. (2015) 'From "gender equality" and "women's empowerment" to global justice: reclaiming a transformative agenda for gender and development', *Third World Quarterly*, 36(2), pp. 396–415.

Cornwall, A., Harrison, E., and Whitehead, A. (2007) 'Gender myths and feminist fables: the struggle for interpretive power in gender and development', *Development and Change*, 38, pp. 1–20.

Doss, C. and Morris, M. (2001) 'How does gender affect the adoption of agricultural innovations? The case of improved maize technology in Ghana', *Agricultural Economics*, 25, pp. 27–39.

Elmhirst, R. and Resurección, B.P. (2020) 'Embodied engagement with gender and agrobiodiversity', in Resurección, B.P. and Elmhirst, R. (eds.) *Negotiating gender expertise in environment and development*. London, UK: Routledge, 115–130.

Esquivel, V. and Sweetman, C. (2016) 'Gender and the sustainable development goals', *Gender and Development*, 24(1), pp. 1–8.

Ferguson, L. (2015) 'This is our gender person', *International Feminist Journal of Politics*, 17, pp. 380–397.

Ferguson, L. (2018) *Gender training: a transformative tool for gender equality*, 1st edn. New York, NY: Palgrave Pivot.

Ferguson, L. (2019) *A theory of change for training for gender equality*, UN Women Training Centre Working Paper. New York, NY: UN Women.

Hafner-Burton, E. and Pollack, M.A. (2002) 'Gender mainstreaming and global governance', *Feminist Legal Studies*, 10, pp. 285–298.

Kabeer, N. (2005) 'Gender equality and women's empowerment: a critical analysis of the third millennium development goal 1', *Gender and Development*, 13, pp. 13–24.

Kingiri, A. (2010) *Gender and agricultural innovation: revisiting the debate through an innovation system perspective*, Discussion Paper 06. London, UK: Research Into Use (RIU).

Koelen, M and Das, E. (2002) 'Social learning: a construction of reality', in Leeuwis, C. and Rybrun, R. (eds.) *Wheelbarrows full of frogs: social learning in rural resource management*. Assen, NL: Koninklijke Van Gorcum, pp. 437–446.

Kolb, D.A. (2015) *Experiential learning: experience as the source of learning and development*, 2nd edn. Saddle River, NJ: Pearson Education.

Kunz, R. (2016) 'Windows of opportunity, Trojan horses, and waves of women on the move: de-colonizing the circulation of feminist knowledges through metaphors?', in Bustelo, M., Ferguson, L., and Forest, M. (eds.) *The politics of feminist knowledge transfer: gender training and gender expertise*. London, UK: Palgrave Macmillan, pp. 99–117.

Leeuwis, C. (2013) *Communication for rural innovation: rethinking agricultural extension*, 3rd edn. Hoboken, NJ: Wiley-Blackwell.

Leeuwis, C. and Aarts, N. (2021) 'Rethinking adoption and diffusion as a collective social process: towards an interactional perspective', in Campos, H. (ed.) *The innovation revolution in agriculture: a roadmap to value creation*. Cham, CH: Springer International, pp. 95–116.

Lombardo, E. and Mergaert, L. (2016) 'Resistance in gender training and mainstreaming processes', in Bustelo, M., Ferguson, L., and Forest, M. (eds.) *The politics of feminist knowledge transfer: gender training and gender expertise*. London, UK: Palgrave Macmillan, pp. 43–61.

Mangheni, M.N., Tufan, H.A., Boonabana, B., Musiimenta, P., Miiro, R., and Njuki, J. (2019) 'Building gender research capacity for non-specialists: lessons and best practices from gender short courses for agricultural researchers in sub-Saharan Africa', in Marcia, T.S., Kristy, K. and Vasilikie, D. (eds.) *Gender and practice: knowledge, policy, organizations*. Bingley, UK: Emerald Publishing, pp. 99–118.

Mangheni, M.N., Musiimenta, P., Boonabaana, B., and Tufan, H.A. (2021a) 'Tracking the gender responsiveness of agricultural research across the research cycle: a monitoring and evaluation framework tested in Uganda and Rwanda', *Journal of Gender, Agriculture and Food Security*, 6(2), pp. 58–72.

Mangheni, M.N., Boonabaana, B., Tufan, H.A., Asiimwe, E., Jenkins, D., and Garner, E. (2021b) 'Developing a competency framework for trainers of gender-responsive agricultural research training programs', *Journal of Gender, Agriculture and Food Security*, 6(2), pp. 41–57.

Mbo'o-Tchouawou, M., Waithanji, E., Mulei, L. and Karugia, J. (2016) *Using an analytical model to explore potential gendered dimensions in agricultural innovation systems*, ReSAKSS ECA Working Paper No. 39. Nairobi, KE: Regional Strategic Analysis and Knowledge Support System East and Central Africa (ReSAKSS ECA).

Moon, K. and Blackman, D. (2014) 'A guide to understanding social science research for natural scientists', *Conservation Biology*, 28(5), pp. 1167–1177.

Moser, C and Moser, A. (2005) 'Gender mainstreaming since Beijing: a review of success and limitations in international institutions', *Gender and Development*, 13(2), pp. 11–22.

Mukhopadhyay, M. (2014) 'Mainstreaming gender or reconstituting the mainstream? Gender knowledge in development', *Journal of International Development*, 26, pp. 356–367.

Mukhopadhyay, M. and Wong, F. (eds.) (2007) *Revisiting gender training: the making and remaking of gender knowledge*, 1st edn. Amsterdam, NL: KIT (Royal Tropical Institute).

Njuki, J. (2016) *Gender integration in research: so where do we start?* Blog of the Journal of Gender, Agriculture and Food Security, July 27. Available at https://agrigenderjournal.word press.com/2016/06/27/gender-integration-in-research-so-where -do-we-start

Oakley, A. (1981) 'Interviewing women: a contradiction in terms?' in Roberts, H. (ed.) *Doing feminist research*. London, UK: Routledge, pp. 30–61.

Okali, C. (2012) *Gender analysis: engaging with rural development and agricultural policy processes*, Future Agricultures Working Paper 26. Brighton, UK: Institute of Development Studies.

Ovenden-Hope, T. and Blandford, S. (2017) *Understanding applied learning: developing effective practice to support all learners*, 1st edn. New York, NY: Routledge.

Porter, F. and Sweetman, C. (eds.) (2005) *Mainstreaming gender in development: a critical review*. Oxford, UK: Oxfam.

Prugl, E. (2016) 'How to wield feminist power', in Bustelo, M., Ferguson, L., and Forest, M. (eds.) *The politics of feminist knowledge transfer: gender training and gender expertise.* London, UK: Palgrave Macmillan, pp. 25–42.

Rubin, D. (2016) *Qualitative methods for gender research in agricultural development*, IFPRI Discussion Paper 01535. Washington, DC: International Food Policy Research Institute (IFPRI).

Sarapura Escobar, S. and Puskur, R. (2014) *Gender capacity development and organizational culture change in the CGIAR Research Program on Aquatic Agricultural Systems: a conceptual framework*, Working Paper AAS-2014-45. Penang, MY: CGIAR Research Program on Aquatic Agricultural Systems (AAS).

Schut, M., Klerkx, L., Rodenburg, J., Kayeke, J., Hinnou, L.C., Raboanarielina, C.M., Adegbola, P.Y., van Ast, A., and Bastiaans, L. (2015) 'RAAIS: Rapid Appraisal of Agricultural Innovation Systems (Part I). A diagnostic tool for integrated analysis of complex problems and innovation capacity', *Agricultural Systems*, 132, pp. 1–11.

Subrahmanian, R. (2004) 'Making sense of gender in shifting institutional contexts: some reflections on gender mainstreaming', *IDS Bulletin*, 35(4), pp. 89–94.

Tickamyer, A.R. and Sexsmith, K. (2019) 'How to do gender research? Feminist perspectives on gender research in agriculture', in Sachs, C.E. (ed.) *Gender, agriculture and agrarian transformations: changing relations in Africa, Latin America and Asia.* New York, NY: Routledge.

Travis, C., Garner, E., Pinto, Y., and Kayobyo, G. (2021) 'Gender capacity development in agriculture: insights from the GREAT monitoring, learning, and evaluation system', *Journal of Gender, Agriculture and Food Security*, 6(2), pp. 19–40.

Wajcman, J. (2010) 'Feminist theories of technology', *Cambridge Journal of Economics*, 34(1), pp. 143–152.

Walby, S. (2005) 'Gender mainstreaming: productive tensions in theory and practice', *Social Politics: International Studies in Gender, State and Society*, 12(3), pp. 321–343.

Weltzien, E., Rattunde, F., Christinck, A., Isaacs, K., and Ashby, J. (2019) 'Gender and farmer preferences for varietal traits: evidence and issues for crop improvement', in Goldman, I. (ed.) *Plant Breeding Reviews, Volume 43*. Hoboken, NJ: Wiley, pp. 243–278.

Wong, F., Vaast, C., and Mukhopadhyay, M. (2016) *Review and mapping exercise for conceptualizing professional development of gender trainers*, UN Women Training Centre and KIT Working Paper. Santo Domingo, DO: UN Women Training Centre.

Notes

1. Crop improvement refers to a broad range of activities at the intersection of agriculture, life, and social sciences.

2. We define gender-responsive research as research that involves the use of social science theories, concepts, methods, and tools to investigate the different needs, priorities, and constraints of both men and women so as to address and reduce them, rather than exacerbating any existing gender inequalities (Rubin 2016).

3. A full list of the training team is available at: greatagriculture.org/great-trainers.

4. The number of participants here does not include participants in courses that ran in 2021, such as the Theme 5 (Crop Improvement) course. This course does not follow the same format of the previous trainings as it was adapted in response to the Covid pandemic precautions and travel restrictions. A reflection on the 292 GREAT participants from 31 countries over five years can be found in Travis et al. (this issue).

5. Note that course fees were reduced for course 2, and the minimum number of participants per team was dropped from three to two, decreasing the overall fees associated with sending a team to the course.

6. Custom courses present a cost-effective alternative, but they require greater institutional buy-in compared to sending a team of two participants to an open-application course. Covid has also presented significant changes to the underlying dynamics for GREAT courses. In response, all courses delivered in 2021 were fully online. At this time, the permanence of these changes is unclear. However, the changes were cost-saving, carbon-saving, and may have reached new participants that otherwise would not have attended. As such, GREAT project management is actively assessing these changes for future course delivery.

7. To measure the application of gender-responsive research to their work, fellows were asked: "How would you rate your level of application of gender-responsive methods/approaches to your research?" Fellows were then asked to describe what methods/approaches they used as follows: "Please describe in more detail the most significant change(s) that you have been able to apply in your research after the GREAT course. Please use specific examples to illustrate the change(s) (e.g. name of the research project, concepts used, the type of activities you undertook, types of methods and/or tools used, guidelines used, etc.) and to show how what you do now differs from your previous approach. Provide a link for each of the projects if available".

Appendix 1   GREAT courses offered.

Course / Theme	Course type	Delivery dates	Delivery model	Location	Orientation
Course 1 – Roots, tubers, and bananas (RTB)	Mainstream	Sep 2016-Feb 2017	3-phase	Uganda	Open enrollment
Course 2 – Cereal grains	Mainstream	Aug 2017-Jan 2018	3-phase	Uganda	Open enrollment
Course 3 – Legumes	Mainstream	Aug 2018-Jan 2019	3-phase	Uganda	Open enrollment
Course 4 – Plant breeding	Mainstream	Jul 2019-Jan 2020	3-phase	Uganda	Open enrollment
Tropical Legumes III (TLIII)	Spin-off	Nov-Dec 2018	6-day	Uganda	Project-commissioned
IRRI / AGGRi East Africa	Spin-off	Nov 2019	6-day	Uganda	Project-commissioned
Burkina Faso (INERA)	Spin-off	Oct 2019	3-day	Burkina Faso	Institution-commissioned

Appendix 2   GREAT course participants.

Course type	Completed courses	Planned courses	Participant demographics				
			Total trained	% NARES	% social scientists	% women	Participant countries (completed courses only)
Mainstream courses 2016-2020	4	1	139	87%	48%	41%	**23 countries**: Benin, Burkina Faso, Burundi, Cameroon, Colombia, Ethiopia, France, Ghana, India, Kenya, Madagascar, Malawi, Mali, Niger, Nigeria, Senegal, Sierra Leone, Tanzania, Thailand, Togo, Uganda, Zambia, Zimbabwe
Custom spin-off courses 2018-2020	4	7	101	90%	34%	41%	**18 countries**: Burkina Faso, Burundi, Côte d'Ivoire, Ethiopia, Ghana, Kenya, Madagascar, Malawi, Mali, Mozambique, Niger, Nigeria, Senegal, Tanzania, Uganda, United States, Zambia
Overall totals:	8	8	240	88%	41%	41%	**26 countries**: Benin, Burkina Faso, Burundi, Cameroon, Colombia, Côte d'Ivoire, Ethiopia, France, Ghana, India, Kenya, Madagascar, Malawi, Mali, Mozambique, Niger, Nigeria, Senegal, Sierra Leone, Tanzania, Thailand, Togo, Uganda, United States, Zambia, Zimbabwe

Appendix   3   Examples of course corrections.

Issue raised	Source	Changes made	Impact / observations
Not enough time / support for self-reflection.	This issue emerged from daily trainers' debriefs, direct feedback from participants, and course MLE reports.	Self-reflection related sessions nearly tripled from course 1 to course 4. The session on "Getting personal with gender" increased from 75 minutes to two hours, and a one-hour session on positionality was added.	This topic emerged in theme 2 as a foundational aspect of buy-in.
Not enough time / support for qualitative methods and analysis.	This issue emerged from daily trainers' debriefs, daily checks with participants, direct feedback from participants, and course MLE reports, with recognition that many participants – including social scientists – had received scant if any professional training in qualitative methods and analysis.	From course 1 to course 4 we more than tripled the amount of time devoted to qualitative methods and analysis: 5.75 hours in course 1, compared to 18 hours in course 4.	Qualitative methods sessions were highly rated for each course, typically in the top-two or three of all course sessions in post-course evaluations. In post-course evaluations, fellows were asked to list the three most significant knowledge / skills / information acquired during the course; across all courses, qualitative data analysis was ranked by more fellows than any other course element, since it was chosen by 69.6 percent, 73.4 percent, and 69.2 percent of fellows in courses 2, 3, 4, respectively.

Appendix   4   List of acronyms for this issue.

CBET	Competency-based education and training
CGIAR	Consultative Group for International Agricultural Research
CoP	Community of Practice
ELT	Experiential Learning Theory
FGD	Focus group discussions
GA	Gender analysis
GREAT	Gender-responsive Researchers Equipped for Agricultural Transformation
GRAR	Gender-responsive agricultural research
GRR	Gender-responsive research
KDA	Knowledge, Desire, Abilities
MLE	Monitoring, Learning and Evaluation
NARES	National agricultural research institutes or universities
PI	Principal investigator
PVS	Participatory varietal selection
RTB	Root, tuber and banana