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From We to Me: Moving Towards an Examination of Self Identity in an Online, Global, Collaborative, Learning Environment

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Abstract. This paper reflects on previous work using QE to examine patterns of discourse of adolescent learners in a virtual, global, collaborative informal learning setting. The collective impact of involvement in the project on participants' experiences was observed in various reflective interviews over the last five years. The deep reflection of this work resulted in a research shift from the general impact on the participants to a shift towards examining how such experiences shape self-identity, such as recognizing identity congruence, relational self, and overcoming negative identity fostered by master narrative frameworks. An initial examination of pre-assessment interviews indicates that younger students are still negotiating their self-understanding, leaving the potential for involvement in the project environment to develop a more thorough understanding of self.

Keywords: Community · Collaboration · Learning · Global · Virtual · Online · STEM · Makerspace · Discourse

1 Introduction

This paper reflects on the use of quantitative ethnography (QE) in an education research project over several years, and its impact on the evolution of research thinking and trajectory as a result. Initially beginning at the end of 2016, the project entailed the engagement of adolescent learners from the U.S. with learners from other countries in a virtual setting for collaborating on the development of STEM-focused media artifacts as a way to foster STEM learning. The project, also called the International Community for Collaborative Content Creation (IC4), began with participants from the U.S., Kenya, and Finland. The IC4 project's theoretical base had emerged from an amalgamation of the maker movement, the rise of user-created video, the psychological dynamics of self-explanation [1], the growth of peer teaching [2], and the changes that technology and social media were precipitating [3] that reversed many traditional classroom roles. Educators were vividly aware that students often were more capable with digital tools both to create and to store knowledge. Contemporary literature, NSF investment directions, and precursor projects all contributed to a rationale for explicitly positioning students as “participatory teachers” – that is, they were to serve as creative agents, generating

instructional content, by which they would learn STEM content more deeply under the mentorship of their school teachers, and develop rich collaboration skills that could serve them well in Global South – Global North collaboration [4]. The construct of participatory teaching and the related construct of help-giving in an international context became the most salient element of planning and central to efforts to win federal support.

Initially intended to focus on asynchronous means of collaboration, the energetic engagement from students when meeting synchronously on video conference calls quickly became the core interest of the project and main source of data collection. These video calls, or global meet-ups, became the source of rich discourse among participants as they shared presentations about STEM topics, provided feedback on artifacts, asked questions and reflected on things they learned.

One of the initial project aims was to develop cultural competence among the participants, and by extension, a tool to assess such competency. However, defining cultural competence for adolescents became an arduous endeavor, due to the layers involved in understanding culture. Rather, there was the realization that the project was more than just attempting to understand and embrace cultural differences, but recognize how the creation of a neutral space for learning can be one where all ways of knowing can be valued.

One of the most notable anecdotal examples of this took place early on in the project at a meet-up in 2017. A female learner from Kenya shared a science presentation about the use of eggshells. While she initially discussed the scientific composition of eggshells, she began to discuss the various benefits and uses for eggshells in her daily life activities which were unfamiliar yet enlightening to her Western counterparts. This example came up as an eye opening presentation for U.S. participants, as well as the researchers, in realizing how valuable other ways of knowing can be. There have been various examples of this since, where students are able to bring aspects of themselves beyond classroom knowledge into the project's learning space, and to enrich learning among peers [5]. While anecdotal accounts tug at heart strings, the need for formal analysis of the data to help convey these accounts became more and more pressing.

1.1 Developing a QE Scholarly Voice

Included in its funding proposal in 2016, the IC4 project sought to utilize a relatively new methodological approach, quantitative ethnography (QE), as its primary technique for analysis. While the project was pushing forward, understanding the use of QE in the data analysis was a moving at a much slower pace. With a limited understanding of how to operationalize QE using epistemic network analysis (ENA), the first research team effort examining reflective interviews was submitted in summer 2018 [6]. In this paper, the researchers sought to “zoom in” on the ENA models of individual participants and how they contributed to collective ENA model representing groups of students. This direction came from a desire to demonstrate that QE had potential for sharing stories from interview data. Shortly after this submission, the researchers participated in an intensive workshop at the lab at the University of Wisconsin-Madison which led to a better understanding of using ENA that would grow with time. The first paper directly following the workshop focused on how the participants in the project developed a shared sense of community over time [7], which began an interest in an analysis of discourse

from the global meet-up data to the collective identity of participation in the project environment.

This led not only to recognition of the richness of data contained in discourse data of adolescent youth from various countries engaging in collaborative STEM learning, but the understanding that ENA could allow for the analysis of the same data from multiple angles depending on the research question. In lieu of pre and post assessments, shifts and changes among participants over time could be better visualized. With the expectation for constant dissemination that comes from a federally funded research project, this became an empowering realization that led to the effort of multiple “short term” papers using QE to analyze discourse data from both global meet-ups and school year end reflective interviews, each contributing something unique to the growing understanding of the dynamics taking place in the project. Overall, these works focused on certain group behavior within the project environment, such as examination on participation level, geographic location (country), and level of prompted discourse [8–10].

While initially led by the core researchers, papers became more led by research assistants as their understanding of using QE also developed to tell the stories they saw emerging in the growing collection of data. This included a longitudinal analysis on a long-term collaboration, revisiting community formation in a maturing project environment, and the student development of emotional intelligence [11–13]. These various papers, focused on analyzing discourse from global meet-ups and post-experience interviews to draw out findings about groups within the project learning setting, led to gradual reflection on the collective results among the studies.

1.2 Reflecting on Various QE Results to a Shift in Thinking

At the project start, the researchers were aware of the dynamics by which adolescents might see themselves differently through their participation in instruction related activities with peers [14]. When the authority figure of the teacher seeks help from the student, the student sees herself or himself differently. The teacher sees that student differently. Peers see that student differently. And the student sees peers differently. Participatory teaching through digital media creation, coupled with the plainly humane and salutary effects of students helping each other, promised to tap into and recruit powerful socio-affective and cognitive mechanisms that were underdeveloped in education research literature.

The actual sequence by which IC4 unfolded and then gave way to the current project, Asset-Based Learning Environments (ABLE), was both unexpected and, in retrospect, enormously reasonable. The expectation that students would focus on creating lessons for their peers in geographically different locations turned out differently in that students focused on doing projects of their own interest and sharing them. In a sense, the students reified the evolution of pedagogical theory, from teacher-centered to student-centered. The researchers expected that students would gravitate readily to the teachers’ role, and readily embrace their sanctioned role as instructional helpers or mentees of professional teachers. The reality represented a slight shift, whereby students found ways to explore their own topics of interest and share those projects simply by sharing about them in the global meetups.

At first approximation, this seems less centered around the help-giving initially aspired to provide and more around indulging a desire by students to share their personal interests. Yet the meet-ups actually intensified the sentiments of help-giving. Students truly did, in both quiet and explicit ways, celebrate the opportunity to come alongside peers in other parts of the world, especially when there was a national income differential. Students from low-income countries eagerly crossed the invisible boundary or working with peers from wealthy countries, and vice-versa. In that process, they wound up continually evidencing deep appreciation for each other and a willingness to learn from one another, though the actual effort was less about teaching each other than about sharing with each other. Among the consistent themes of IC4 identified from meet-up data was the routine generosity students extended to each other after sharing, and the routine pleasure that students shared simply to work alongside one another. The researchers struggled as project leaders with many aspects of project selection, definition, and execution. But the students consistently lived out the project's aspirations to build a supportive community, which was originally and accurately identified as a help-giving community.

But sharing projects of interest differs substantially from directly creating teaching experiences under the rubric of participatory teaching. Meanwhile, the dynamics of adolescents seeing each other differently, seeing their peers differently, and seeing their teachers differently continually emerged in student reflections and in student interviews. Perhaps more than anything, pre-teens and teens reported developing poise and confidence through the collaborative exchanges through which they developed stronger STEM competencies. There were numerous event markers also, by which student STEM experiences appeared to transcend traditional stereotypes of under-resourced versus wealthy and that undermined traditional gender stereotypes. The IC4 project suggested to participants that unhealthy identity expectations -who they thought they were – did not conform to how they came to view themselves in a healthy, international collaborative experience. They continually report that the satisfaction and satisfaction of collaboration with peers from other countries shaped their sense of confidence, poise, and how they saw themselves in an international context.

The construct of participatory teaching and help-giving seemed a clever and compelling pursuit within IC4 project. In retrospect, the transactional component of students teaching one another way to the slight shift that focused on students sharing with each other. The emotional and intellectual energy of the sharing and support process seemed to convert to the dynamic the researchers had expected and hoped for from the outset – that students would see themselves, their peers, and their teachers differently. The participatory teaching construct had merits but the construct proved subordinate to the more pressing and important changes that were shaping how students envisioned themselves as “STEM” people in global collaboration. Realizing that this is where interactions and data took the project led simply to making that identity formation the primary research focus of the successor project.

1.3 Embarking on a New Research Direction

As a result of this deep reflection on various QE results, the researchers embarked on the aforementioned new project effort (ABLE) with a research focus on identity development. This intends to closely focus on individual shifts in how participants view themselves (“me”), alongside ongoing collective behavior observed in the project community (“we”). While aspects of the project remain the same, involving adolescent learners in a global, collaborative, informal STEM-focused learning environment, there are now some key design changes to build on the previous project. Primarily led by schools in the U.S (formerly led by just the researchers), participants will partake in not only co-creating STEM-focused media artifacts, but developing idea cards for other participants to consider responding to. Regarding composition of participants, there is a larger focus on the inclusion of learners from historically marginalized groups in the U.S. One of the key research aims is by participating in a global learning environment where different ways of knowing and understanding are embraced, students will overcome any negative identity associations and develop identity congruence both as STEM learners and as collaborative, global citizens.

The remaining sections of the paper provide an initial analysis of the pre-experience interviews of participants in the new ABLE program. While preliminary, this exemplifies the shift in focusing on how students see themselves, and how that can potentially develop with their involvement in the program.

2 Methods

The data analyzed in this section was collected through semi-structured pre-experience interviews with 22 ABLE participants in March and April 2023. The sample consists of learners spanning from grade school to high school from the countries of Kenya and the U.S., as shown in Table 1. The interview questions revolved around the learners’ identity based on how they see themselves within their community. Learners were also asked questions pertaining to their interests, self-determined strengths and weaknesses in the STEM context, and their hopes or aspirations in the future. The interviews took place via Zoom, with each interview recorded and then transcribed.

Table 1. ABLE participants interviewed for this study

Participants from Kenya				Participants from US			
ID	Assumed Gender	Age	Grade Category	ID	Assumed Gender	Age	Grade Category
1	F	14	Secondary	11	M	13	Middle
2	F	14	Secondary	12	M	13	Middle
3	F	16	Secondary	13	M	13	Middle
4	F	11	Middle	14	M	13	Middle
5	F	15	Secondary	15	F	12	Middle
6	F	16	Secondary	16	M	11	Middle
7	F	16	Secondary	17	M	12	Middle
8	M	15	Secondary	18	M	12	Middle
9	M	11	Middle	19	F	17	Secondary
10	F	8	Elementary	20	M	12	Middle
				21	M	12	Middle
				22	F	12	Middle

A codebook from an iterative, grounded analysis of the data was generated and contained a total of 12 constructs, seen in Table 2. Each interview was independently coded by two raters using the codebook, who then came together in a process of social moderation to reach agreement on the final coding for 3,131 total utterances included in the dataset [15].

Table 2. ABLE Participant Analysis Codebook

Code	Definition & Sample Utterance	
Emotional Awareness	Definition:	Recognition of personal responses to situations, more focused on the self
	Sample:	“I am shy. I get nervous.”
Social Awareness	Definition:	Recognition of other people’s responses, more focused on others
	Sample:	[It’s important to work with others, because] “the fact that it brings people together.”
Technology Use	Definition:	Use of technology tools not just conceptual or subject
	Sample:	“I’ve made many PowerPoints about Mars and Jupiter, I presented to my whole class. Do you want to see?”
STEM Orientation	Definition:	Science, technology, engineering, math as subjects or concepts

(continued)

Table 2. (continued)

Code	Definition & Sample Utterance	
	Sample:	“I think, when I was in elementary like primary the science was like one subject, but it had all of these things to do with physics, maths, but we never really realized it.”
Global/Cultural Awareness	Definition:	Recognition of differences that could arise based on culture, a global perspective
	Sample:	“My parents were immigrants from India and I was born here in America and I feel like learning to kind of not balance but understand my bi-cultural identity.”
Collaborative Orientation	Definition:	Recognition of needing others to accomplish something, desire to work with others
	Sample:	“But then, I know it’s a must to do it together that we can achieve something bigger. So yeah.”
Independent Orientation	Definition:	Reliance of self rather than others in the accomplishment of something, self-reliant disposition
	Sample:	“But then I look at it and say, like, you know, I can figure this out and I can make it work.”
Personality Attributes	Definition:	Individual identity, what I do or how I am, does not include future orientation
	Sample:	“Sometimes [I’m] a little funny and I’m kind.”
Social Attributes	Definition:	Identification of a particular social construct grouping, social identity
	Sample:	“I also do Girl Scouts so that kind of helps definitely a lot with like leadership skills and things.”
Self-efficacy	Definition:	Recognition of being exceptionally good at something
	Sample:	“I feel like I’m really strong in math and a little bit in science.”
Challenge Awareness	Definition:	Recognition of not being good at something
	Sample:	“Maybe, like, sometimes I feel like I get distracted a bit easily.”
Support Appreciation	Definition:	Acknowledging general help/support from a specific individual
	Sample:	“My teacher is really encouraging and really helped me along with that process.”

After the social moderation process, models were generated using the ENA webtool. ENA, an approach operationalizing quantitative ethnography, creates visualization of data through the patterns of connections between constructs [16]. For this analysis, the speaker was identified as the unit of analysis and the response to a question within an interview was defined as the conversations in which connections were limited. The edge weights were scaled to 1.5 in order to better visualize the connections in the data.

3 Results

The resulting ENA network models are below, providing an overall pattern of the interviews, followed by an examination by country and school age group. Three constructs initially coded for (Collaborative, Global/Cultural Awareness, and Support Awareness) were removed from the models in order to focus the analysis on most relevant constructs.

For all the models, the nodes (dots) represent the different constructs that were coded for, and edges (lines) are the weighted connections between the constructs. Thicker lines indicate stronger connections, while thinner lines indicate less connection.

3.1 Overall Model

The overall pattern of interviews can be seen in Fig. 1, defined by Social Attributes at the top, Self-Efficacy and STEM-Orientation at the bottom and left, and Independent on the right. The strongest connections are on the bottom left constructs including Challenge/Deficiency with STEM Orientation and Self-Efficacy, which illustrates a part in the interview where participants reflect on how they see themselves in various roles. Overall, Personality Attributes are more connected than Social Attributes, indicating how students identify by their personality rather than the social in-groups they perceive themselves to be part of.

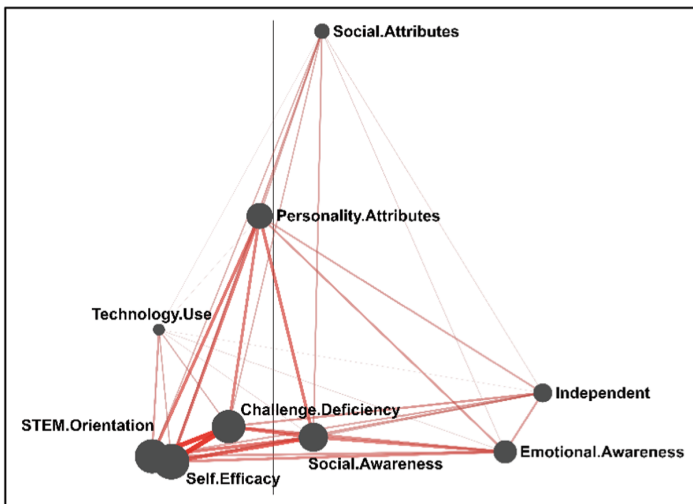


Fig. 1. ENA network model across all pre-experience interviews conducted.

3.2 Examination by Country

An examination of the interviews by country, Kenya and U.S., is seen through a subtracted network model in Fig. 2. A means rotation was utilized to maximize the key differences between the two along the X axis. Participants from the U.S. had constructs more connected on the left side of the model, most prominently depicted between Technology Use, STEM Orientation, and Self-Efficacy. Participants from Kenya were mostly connected with constructs on the right, such as Independent and Personality attributes.

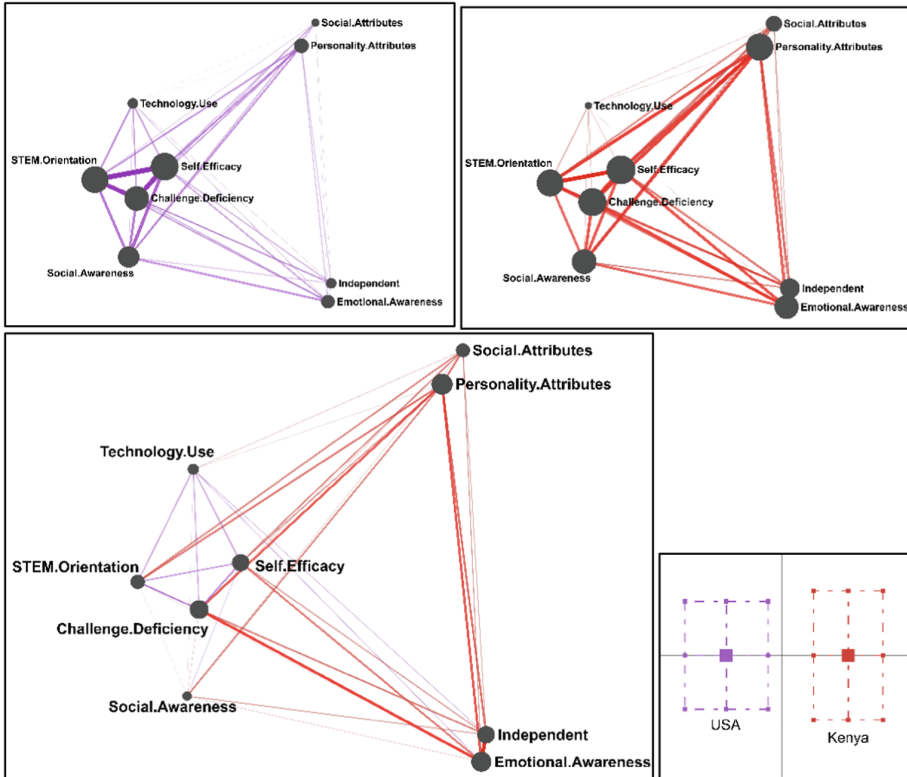


Fig. 2. Subtracted ENA network model of U.S. participants (purple, upper left) and Kenya participants (red, upper right) on the bottom left and their respective confidence intervals on the bottom right (Color figure online).

3.3 Examination by Grade Level

Figure 3 provides a subtracted network model of the interviews by grade level, with middle school in purple on the left and high school on the right. Similar to the results seen in Fig. 2, one group, the high school students, had a richer network model in general and were more focused on the right side of the model, including strong connections to Personality Attributes, Independent, Emotional Awareness, Challenge/Deficiency and Social Awareness. In comparison, the middle school group had less distinct connections, which were focused mostly on the lower left side of the model, with strong constructs connected to Technology Use and STEM Orientation.

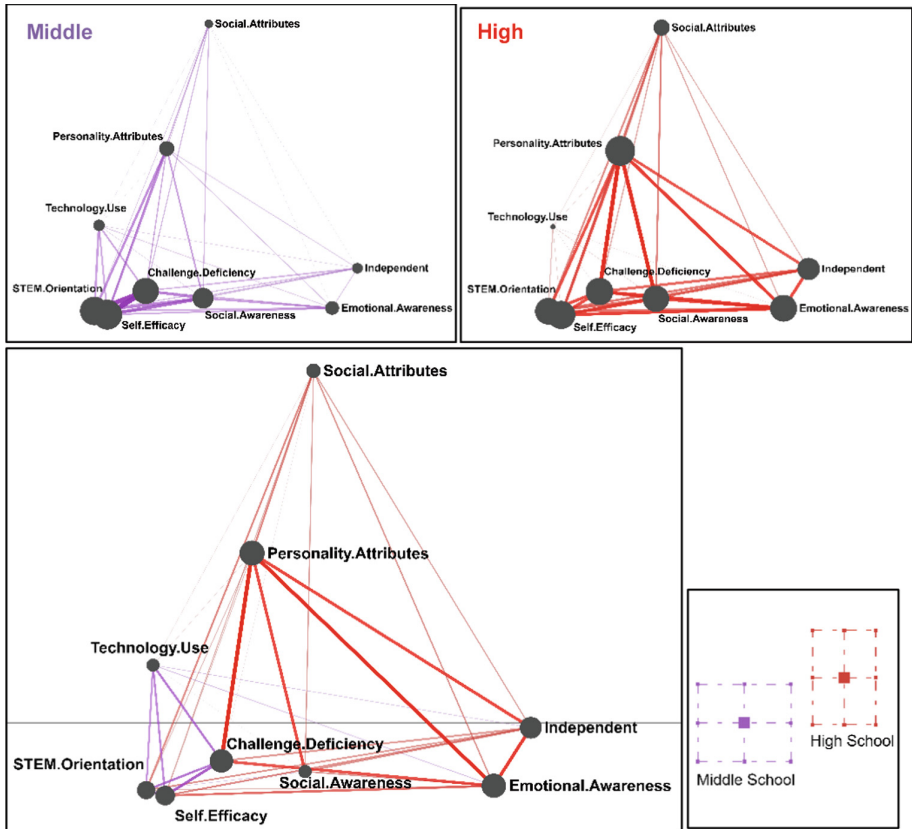


Fig. 3. Subtracted ENA network model (lower left) of middle school age participants (purple, upper left) and high school age participants (red, upper right) and their respective confidence intervals (right) (Color figure online).

4 Discussion

The examination of these pre-experience interviews provides an initial reporting of how participants currently see themselves, with the intent to track changes as a result of their participation in the ABLE project. In examining the comparison of construct patterns in the ENA models between countries (US and Kenya), students in Kenya reflected in a richer way compared to the students in the U.S., who had thinner connected models. A similar pattern was observed when examining the models by grade level, where middle school students had less rich connections, which were all focused on the lower left of the model, connecting between Technology Use, STEM-Orientation, Self-Efficacy and Challenge/Deficiency.

The parallel patterns of connection among the two subtracted models is not surprising, given that most Kenyan participants are high school age and most U.S. participants

are in middle school. The differences in the richness of their discourse can be illustrated by a comparison to their response to the same question, which asked about future aspirations:

Kenyan Student: The things I would mention I have aspirations. I aspire to be a botanist. I really got interested into plants lately so I have been doing my research since I got, I found out about this project. I wanted to find out what would happen, like whether it would assist me in some kind of way.

U.S. Student: I would want to pursue engineering or engineering designs.

While the more sparse network model can be attributed to age, it also indicates an opportunity for the project experience to have a lasting impact that can develop and affirm a positive sense of self. This is evidenced from a pre-experience interview with a U.S. high school student who participated in the precursor project, IC4, throughout middle school.

US Student: I've been a part of well, I had been a part of IC4 before it had ended, and I think I'd been part of it for seven years since I was in sixth grade up until last year when it ended. It helped me introduce me a lot to not only the science field, but how I can mix my interests with biological sciences and technology together, which I thought was really fascinating.

Like academic was in like extracurricular wise and growing up, you know, I was a really big reader, so at first when I was younger, I was like, Oh, I really love literature and maybe this is something I want to pursue and then through clubs in middle school such as IC4 and two other technology related clubs and STEM clubs, I started realizing that my interests, even though I enjoyed literature, I was really intrigued by math and science. So I think that's why they're really important to me, and I'd like them to be an integral part of my future career and educational opportunities.

This reflection illustrates the potential for how an experience in the ABLE project can strengthen a learner's sense of self identity over time. While the more sparse network model can be attributed to age, it also indicates an opportunity for the program experience to have a lasting impact that can develop and affirm a positive sense of self. A comparison with post-experience interviews will provide further insight into assessing these ideas.

The contribution of this paper is not merely in service of reporting on the results of an analysis of pre-experience interviews. Rather, this paper aims to illustrate a result of "slow research" developing in parallel to the usual, urgent pace of dissemination [17, 18]. It takes the opportunity to reflect on and document the evolution of research thinking that came from ongoing reflection over time in using QE as a primary methodological approach. The precursor project allowed exploration into telling collective stories about groups of participants ("we"), leading to an interest in examining how the experience impacts an individual's shift in thinking about themselves ("me") in the current endeavor. In parallel to examining shifts of student participant thoughts about self, the researchers aim to continue reflecting on how to use QE to share the stories of their own shifts in thinking.

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