Supplemental Material

CBE—Life Sciences Education

Chen Musgrove et al.

Supplemental Materials

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Pre/Post-Conference Survey

Q1 **Title of research study:** Examination of provided supports and results of participation in CC Bio INSITES

IRB Protocol Number: 17-0389

Investigator: Lisa Corwin

Sponsor: The National Science Foundation: Research Coordination Networks for Undergraduate Biology Education Program

Purpose of the Study

The purpose of the study is to better understand how social networks, such as the CC Bio INSITES network, provide intellectual, social, and resource support for their participants. These three categories of support were identified by members of a pilot meeting as the kinds of supports needed for CC instructors to engage in Biology Education Research (BER). By understanding how a network can provide these benefits, we will be informing both our knowledge of whether our network is functioning as intended and also how to successfully build social networks to provide specific kinds of support. This work will benefit CC Bio INSITES network members by improving the network itself, and it will benefit society through contributing knowledge of effective network administration more broadly.

We invite you to take part in this research study because you are a member and/or an involved advocate of the CC Bio INSITES network.

We expect that you will participate sporadically in this research study for the duration of the CC Bio INSITES grant funding, five years. Participation will involve filling out surveys, deciding whether to participate in focus groups associated with the study, and providing information on the products (e.g., posters or publications) you might produce in association with network activities.

We expect to invite all network members (up to 200 people over the next five years) to participate in this research study.

Explanation of Procedures

As a participant in this study, we will ask you to complete online surveys before and after all network meetings that you attend. At the time of each survey, we will send you an invitation and no more than three reminder emails about the study invitation. **Each survey should last between 10 and 20 minutes, but should take no longer than 30 min maximum to complete.** These surveys ask about your thoughts and feelings regarding the network and biology education research in general, your use of network resources and access to resources, and your interactions with other network members. We request that all network participants who participate in the study do so with the intention of completing all surveys.

We will also ask you to consider participating in virtual online focus groups associated with the study. These will be conducted after the first network meeting, twice during the year between the first and final network meeting, and after the final network meeting. **During the time of the surveys, we will ask you if you agree to be contacted for participation in a focus group.** If you agree, we will follow up with a focus group invitation email and no more than three reminders about the focus group invitation. Focus groups will ask about your experiences with network functions and supports and gather feedback on how the network can improve. If all members of the focus group agree, audio recordings of the focus group will be taken and transcribed for data collection. Not all network members will need to participate in all focus groups. Therefore, if you choose to participate in this component of the study, we would not ask you to participate in more than two focus groups maximum. Focus groups are expected to last approximately an hour and no longer than 1.5 hours.

Finally, we will ask participants to provide copies of products that were supported in some way by the network. Examples of these products might include copies of abstracts, posters and papers presented or published. We will request these at the time of survey distribution in the survey and will send no more than three reminders to send us these materials.

All communication (e.g., survey distribution and emails) will be conducted by a member of the research team who is not a key facilitator for CC Bio INSITES (i.e., not Corwin, Schinske, Fletcher, or Nenortas). A member of the research team who is not a key facilitator will also conduct the online focus groups and all data collection and will de-identify any data collected prior to when the members of the research team who are also part of CC Bio INSITES (Corwin and Schinske) view the data. With these procedures, **key CC Bio INSITES facilitators will not be able to identify who responded or match responses to identities.**

Voluntary Participation and Withdrawal
Whether or not you take part in this research is your choice. You can leave the research at any time and it will not be held against you. If you choose to withdraw from the study, you may decide at that time if you wish to retroactively withdraw all of the information provided to that point, or allow use of that information and not provide any further information.

If you are a CU Boulder student or employee, taking part in this research is not part of your class work or duties. You can refuse to enroll, or withdraw after enrolling at any time, with no effect on your class standing, grades, or job at CU Boulder. You will not be offered or receive any special consideration if you take part in this research.

Risks and Discomforts
There are minimal risks to participating in this study. Although unlikely, some of the survey questions or focus group questions may make you feel uncomfortable. It is important for you to know that you can choose not to answer any of the questions or stop participating at any time. There is also a slight risk of breach of confidentiality of your data, given that we are collecting data using electronic devices and that we are conducting focus groups, in which we cannot guarantee your responses will be kept confidential. We are taking precautions to prevent these risks by keeping data on secure servers, in locked rooms, or on locked devices. We will also discuss confidentiality in focus groups, should you choose to participate. All data presented as a

result of this research will be anonymous and contain no information that could be used to identify who you are.

Potential Benefits
We cannot promise any benefits to you or others from your taking part in this research. However, results from this study will help us understand what motivates community college faculty to engage in CC BER, the barriers they encounter, and how our network is functioning to support CC BER and alleviate specific barriers. These results will be helpful in designing professional development experiences or supports that target some of these barriers. Furthermore, the results will be useful for creating a sustainable and functional CC BER network that will continue to offer the supports that CC faculty need to engage in this important work. The direct benefit that you *may* receive from this work is that it will be used to inform the functions and administration of the CC Bio INSITES network, which you are a part of. Thus, you could benefit from initiatives born out of the research results.

Benefits for society at large include the potential for the CC Bio INSITES network to have impact on a large numbers of students from underserved backgrounds in STEM education. Increasing the quantity and quality of CC BER and the awareness of its importance in spurring institutional change has potential to spur innovations that will improve STEM education for a vast number of underserved students. Thus, this will help improve instruction at two-and four-year institutions alike.

Confidentiality
Information obtained about you for this study will be kept confidential to the extent allowed by law. Research information that identifies you may be shared with the University of Colorado Boulder Institutional Review Board (IRB), other collaborating institutions, and others who are responsible for ensuring compliance with laws and regulations related to research, including people on behalf of the Office for Human Research Protections. The information from this research may be published for scientific purposes; however, your identity will not be given out.

This study will generate audio recordings of the focus group which may be identifiable. Within one month after audio recordings are taken, they will be transcribed and the audio recordings will be deleted after transcription is complete (within three months maximum after collection).

Payment for Participation
You will not be paid to be in this study.

Questions
If you have questions, concerns, or complaints, or think the research has hurt you, talk to the research team at lisa.corwin@colorado.edu.
This research has been reviewed and approved by an IRB. You may talk to them at (303) 735-3702 or irbadmin@colorado.edu if:

· Your questions, concerns, or complaints are not being answered by the research team.
· You cannot reach the research team.
· You want to talk to someone besides the research team.

·   You have questions about your rights as a research subject.
·   You want to get information or provide input about this research.

Q2 If you agree to participate, please select "I agree to participate." below.
 If you do not wish to participate, please select "I decline to participate." below.

○ I agree to participate (1)

○ I decline participation (2)

Q3 Thank you for agreeing to participate! The following questions ask you about your access to biology education research supports.

Q4 To what extent are the following resources available to you...

	Not Available (1)	Available but I never used it (2)	Available, I used it once (3)	Available, I used it a few times (4)	Available, I use it frequently (5)	I don't know/not applicable (6)
An Institutional Review Board (IRB) at your institution (1)	○	○	○	○	○	○
An IRB through another institution (2)	○	○	○	○	○	○
Grants office at your institution (3)	○	○	○	○	○	○
Grants office at another institution (19)	○	○	○	○	○	○
Information sessions on regional and national funding sources (17)	○	○	○	○	○	○

Funding to attend conferences or workshops (4)	○	○	○	○	○	○
Support for submitting papers for publications (7)	○	○	○	○	○	○
Training sessions on practices in education research (not including the upcoming INSITES meeting) (15)	○	○	○	○	○	○
Funding to support faculty learning communities interested in biology education research (9)	○	○	○	○	○	○
Education research journal subscriptions (13)	○	○	○	○	○	○
Texts or resources that support biology education research learning and skill development (10)	○	○	○	○	○	○

Quantitative data analysis software (e.g., R, STATA or SPSS) (12)	○	○	○	○	○	○
Qualitative data analysis software (e.g., NVivo, MAXQDA, HyperResearch) (11)	○	○	○	○	○	○
Survey creation resources (i.e. Qualtrics, SurveyMonkey) (16)	○	○	○	○	○	○
Other (18)	○	○	○	○	○	○

Q5 What other resources would you like in the future that have not already been listed?

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_____

_____

_____

Page Break

Q6 If, in the last three years, you have attended an education section at a disciplinary

conference (e.g., the education section at the Annual Meeting of the American Society for Cell Biology) please list the conference name below (e.g., ASCB Conference, 2016). Please put "N/A" if you have not attended an education section at a disciplinary conference.

_____

_____

_____

_____

_____

Q7 Which, if any, teaching conferences do you plan on attending in the next year? Select all that apply.

☐ AAC&U - American Association of Colleges and Universities (9)

☐ ABLE - Association for Biology Laboratory Education (5)

☐ ASM-CUE - American Society for Microbiology - Conference for Undergraduate Educators (7)

☐ BioQuest (2)

☐ Gordon Research Conference on Biology Education Research (4)

☐ HAPS - Human Anatomy and Physiology Society (8)

☐ Innovations - League for Innovation in the Community College (15)

☐ NABT - National Association of Biology Teachers (3)

☐ NARST - National Association of Research in Science Teaching (6)

☐   NSTA - National Science Teachers Association (13)

☐   SABER - Society for the Advancement of Biology Education Research (1)

☐   SABER West Regional Conference (14)

☐   None of Above (12)

☐   Other (10) _____

☐   I prefer not to respond (11)

Q8 Which, if any, teaching conferences have you attended in the last three years? Select all that apply.

☐   AAC&U - American Association of Colleges and Universities (9)

☐   ABLE - Association for Biology Laboratory Education (5)

☐   ASM-CUE - American Society for Microbiology - Conference for Undergraduate Educators (7)

☐   BioQuest (2)

☐   Gordon Research Conference on Biology Education Research (4)

☐   HAPS - Human Anatomy and Physiology Society (8)

☐   Innovations - League for Innovation in the Community College (15)

☐   NABT - National Association of Biology Teachers (3)

☐   NARST - National Association of Research in Science Teaching (6)

☐   NSTA - National Science Teachers Association (13)

☐   SABER - Society for the Advancement of Biology Education Research (1)

☐   SABER West Regional Conference (14)

☐   None of Above (12)

☐   Other (10) _____

☐   I prefer not to respond (11)

Page Break

End of Block: Resource/Infrastructure

Start of Block: Intellectual / Confidence

Q9 The following questions ask you about using research-based practice and assessment to inform classroom practice.

Q10 How often did you engage in the following practices during the last year?

	Never (1)	Once (2)	A few times (3)	Occasionally (4)	Regularly (5)	I prefer not to respond (6)	I don't know (7)
Implemented evidence based practices in biology instruction (e.g. active learning) (1)	○	○	○	○	○	○	○
Read biology education research papers (11)	○	○	○	○	○	○	○
Used pre/post tests of your own design to collect evidence of student outcomes (3)	○	○	○	○	○	○	○
Used published pre/post tests of other's design to collect evidence of student outcomes (4)	○	○	○	○	○	○	○

Used surveys of your own design to collect information about student learning, affect or behavior (5)	○	○	○	○	○	○	○
Used published surveys of other's design to collect information about student learning, affect or behavior (6)	○	○	○	○	○	○	○

Q11 How confident are you in your ability to perform the following tasks?

	Not at all confident (1)	Somewhat confident (2)	Confident (3)	Highly confident (4)	Absolutely confident (5)	I prefer not to respond (6)	I don't know (7)
Implement evidence based practices in biology instruction (e.g. active learning) (1)	○	○	○	○	○	○	○

Read and understand biology education research papers (11)	○	○	○	○	○	○	○
Use pre/post tests of your own design to collect evidence of student outcomes (3)	○	○	○	○	○	○	○
Use published pre/post tests of other's design to collect evidence of student outcomes (4)	○	○	○	○	○	○	○
Use surveys of your own design to collect information about student learning, affect or behavior (5)	○	○	○	○	○	○	○

Use published surveys of other's design to collect information about student learning, affect or behavior (6)	○	○	○	○	○	○	○

Q12 The following questions ask you about practices associated with conducting biology education research.

Q13 How often have you engaged in the following practices within the last year?

	Never (1)	Once (2)	A few times (3)	Occasionally (4)	Regularly (5)	I prefer not to respond (6)	I don't know (7)
Participated in other people's biology education research projects (16)	○	○	○	○	○	○	○
Generated biology education research questions of interest to you (12)	○	○	○	○	○	○	○

Designed your own biology education research study (14)	○	○	○	○	○	○	○
Wrote an IRB for your own study or collaborated on an IRB for someone else's study (13)	○	○	○	○	○	○	○

Q14 How confident are you in your ability to perform the following tasks?

	Not at all confident (1)	Somewhat confident (2)	Confident (3)	Highly confident (4)	Absolutely confident (5)	I prefer not to respond (6)	I don't know (7)
Participate in other people's biology education research projects (16)	○	○	○	○	○	○	○
Generate biology education research questions of interest to you (12)	○	○	○	○	○	○	○

Design my own biology education research study (14)	○	○	○	○	○	○	○
Write an IRB for my own study or collaborate on an IRB for someone else's study (13)	○	○	○	○	○	○	○

Page Break

Q15 How often have you engaged in the following practices within the last year?

	Never (1)	Once (2)	A few times (3)	Occasionall y (4)	Regularly (5)	I prefer not to respond (6)	I don't know (7)
Collected **quantitativ e** evidence (e.g., likert-like survey data, numeric data) for biology education research (17)	○	○	○	○	○	○	○

Collected **qualitative** evidence (e.g., essays, interviews, or focus groups) for biology education research (18)	○	○	○	○	○	○	○
Performed **statistical** analyses for biology education research (19)	○	○	○	○	○	○	○
Performed **qualitative** analyses for biology education research (20)	○	○	○	○	○	○	○
Included ways to account for differences among participants when designing your own biology education research (23)	○	○	○	○	○	○	○

Discussed biology education research evidence you collected with colleagues **in your department** or at your institution (2)	○	○	○	○	○	○	○
Discussed biology education research evidence you collected with colleagues **outside** of your institution (3)	○	○	○	○	○	○	○

Q16 How confident are you in your ability to perform the following tasks?

	Not at all confident (1)	Somewhat confident (2)	Confident (3)	Highly confident (4)	Absolutely confident (5)	I prefer not to respond (6)	I don't know (7)

Collect **quantitativ e** evidence (e.g., likert-like survey data, numeric data) for biology education research (17)	○	○	○	○	○	○	○
Collect **qualitative** evidence (e.g., essays, interviews, or focus groups) for biology education research (18)	○	○	○	○	○	○	○
Perform **statistical** analyses for biology education research (19)	○	○	○	○	○	○	○
Perform **qualitative** analyses in the area of biology education research (20)	○	○	○	○	○	○	○

Include ways to account for differences among participants when designing your own biology education research (24)	○	○	○	○	○	○	○
Discuss biology education evidence you collected with other colleagues **in your department** or at your institution (2)	○	○	○	○	○	○	○
Discuss biology education evidence you collected with other colleagues **outside** of your institution (3)	○	○	○	○	○	○	○

Page Break

Q17 These questions ask you to quantify the number of times you have done the following items associated with biology education research practices. Enter the number of times **in the last year** that you...

Q18 ...presented a poster or gave a talk **at your institution** on evidence you collected regarding biology education.

_____

Q19 ...presented a poster or gave a talk **outside of your institution** on evidence you collected regarding biology education.

_____

Q20 ...submitted biology education research or curricula **to non-peer reviewed** venues.

_____

Q21 ...submitted biology education research or curricula **to peer reviewed** venues

_____

Q22 ...spoke with funding agency representatives regarding biology education research.

_____

Q23 ...submitted grant proposals to support biology education research.

_____

Q24 ...served as a peer reviewer for biology education research papers.

_____

Q25 ...attended education or biology education conferences.

_____

Q26 How confident are you in your ability to perform the following tasks?

	Not at all confident (1)	Somewhat confident (2)	Confident (3)	Highly confident (4)	Absolutely confident (5)	I prefer not to respond (6)	I don't know (7)
present a poster or give a talk **at your institution** on evidence you collected regarding biology education (17)	○	○	○	○	○	○	○
present a poster or give a talk **outside of your institution** on evidence you collected regarding biology education. (18)	○	○	○	○	○	○	○

publish biology education research in **non-peer-reviewed** venues. (19)	○	○	○	○	○	○	○
publish biology education research in **peer-reviewed** venues. (20)	○	○	○	○	○	○	○
speak with funding agency representatives regarding biology education research (24)	○	○	○	○	○	○	○
Write successful grant proposals to support biology education research (2)	○	○	○	○	○	○	○
Serve as a peer-reviewer for biology education research journals (3)	○	○	○	○	○	○	○

Q27 The following questions ask you about your relationship with the **CC Bio INSITES Network.**

Please respond to the following statements based on your relationship with this group.

Q28 To what extent do you agree with the following statements.

	Strongly disagree (1)	Disagree (2)	Neither agree nor disagree (14)	Agree (15)	Strongly agree (16)	Prefer not to respond (17)	I don't know (3)
I feel a sense of belonging to the CC Bio INSITES network (6)	○	○	○	○	○	○	○
I feel that I am a member of the CC Bio INSITES network (2)	○	○	○	○	○	○	○
I see myself as part of the CC Bio INSITES network (10)	○	○	○	○	○	○	○
I am enthusiastic about being a part of the CC Bio INSITES network (8)	○	○	○	○	○	○	○
I am happy to be a member of the CC Bio INSITES network (4)	○	○	○	○	○	○	○

The CC Bio INSITES network is one of the best research communities in the country (12)	○	○	○	○	○	○	○

Q29 The following questions ask you about your relationship to the **Biology Education Research Community.** When we mention the biology education research community, we are referring to the broad group of people involved in that field, including faculty, instructors, administrators, and students that conduct biology education research nationally.

Please respond to the following statements based on your relationship with this group.

Q30 To what extent do you agree with the following statements.

	Strongly disagree (1)	Disagree (2)	Neither agree nor disagree (14)	Agree (15)	Strongly agree (16)	Prefer not to respond (17)	I don't know (3)
I feel a sense of belonging to the biology education research community (5)	○	○	○	○	○	○	○

I feel that I am a member of the biology education research community (1)	○	○	○	○	○	○	○
I see myself as part of the biology education research community (9)	○	○	○	○	○	○	○
I am enthusiastic about being a part of the biology education research community (7)	○	○	○	○	○	○	○
I am happy to be a member of the biology education research community (3)	○	○	○	○	○	○	○
The biology education research community is one of the best research communities in the country (11)	○	○	○	○	○	○	○

Page Break

End of Block: Belonging, Identity

Start of Block: Social Network Analysis

Q31 As part of this research we are conducting social network analysis which examines the growth of networks and formation of new relationships among network members. We are curious about the supports members provide to each other as a result of network interactions.

Social support is defined as the emotional support, camaraderie, and encouragement that is gained through social interactions with other network members. This type of support is defined by the supporting individual having the disposition and desire to support and encourage you.

Intellectual support is defined as the access to knowledge that supports engagement in BER. For example, having a network member explain how to do a certain analysis or forming a collaboration with someone because they have a specific expertise would be forms of intellectual support. This type of support is defined by the supporting individual having the knowledge or skill needed to assist you.

Resource support is defined as the access to resources that enable BER work. For example if a network member provides another member with access to an IRB, journal articles, or funds to do BER this would be considered resource support. This type of support is defined by the supporting individual having the resources to assist you or ways for you to get those resources.

Q32 Please check the box **if you have interacted with the listed individual** and **check any corresponding boxes if they have offered you specific types of support.** Note - You may select more than one option for any individual.

Please select individuals you have worked with in the last year (since the last national CC Bio INSITES meeting).

We greatly appreciate your time in considering the types of support you have received and whom has provided them.

This first set of individuals joined CC Bio INSITES at the inaugural meeting in May 2018

<div align="center">Types of Support</div>

	I interacted with this person in the last year (1)	Social Support (2)	Intellectual Support (3)	Resource Support (4)	Other Support (5)	This is me (6)
Name of Participant	☐	☐	☐	☐	☐	☐

Q40 If you checked the "other" box above, please explain the types of support you were referring to.

_____

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Q41 If you have received social support in pursuing BER from people other than those listed above, please list names of up to three individuals who offer you **social** support.

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_____

Q42 If you have received intellectual support in pursuing BER from people other than those listed above, please list names of up to three individuals who offer you **intellectual** support.

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Q43 If you have received infrastructure or resource support in pursuing BER from people other than those listed above, please list names of up to three individuals who offer you infrastructure or resource support.

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_____

Q44 The following questions ask you to describe the kinds of support that you have received through your interactions with the CC Bio INSITES network. As a reminder, here are the descriptions of the types of support:

Social support is defined as the emotional support, camaraderie, and encouragement that is gained through social interactions with other network members. This type of support is defined by the supporting individual having the disposition and desire to support and encourage you.

Intellectual support is defined as the access to knowledge that supports engagement in BER. For example, having a network member explain how to do a certain analysis or forming a collaboration with someone because they have a specific expertise would be forms of intellectual support. This type of support is defined by the supporting individual having the knowledge needed to assist you.

Resource support is defined as the access to resources that enable BER work. For example if a network member provides another member with access to an IRB, journal articles, or funds to do BER this would be considered resource support. This type of support is defined by the supporting individual having the resources to assist you or ways for you to get you those resources.

Q45 Please comment on whether you have received **social** support through CC Bio INSITES, and if so, describe the support you have received.

_____

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Q46 Please comment on whether you have received **intellectual** support through CC Bio INSITES, and if so, describe the support you have received.

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_____

_____

_____

Q47 Please comment on whether you have received **infrastructure and resource** support through CC Bio INSITES, and if so, describe the support you have received.

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Q48 We will use the following information to match your survey to future surveys . Your name will not be included in any reports about results and will be separated from this data as soon as possible. The meeting facilitators will never see your name in connection to your survey responses.

Please type your name.

_____

Q49 Please type an email address that we can use to contact you for future surveys.

_____

Q64 Please list products that have been supported by your work with CC Bio INSITES in the last year (i.e., since May 2019). Note that these will be separated from your responses and archived as *identifiable* artifacts. Examples of products include: published research studies or curricula, preprints, posters presented at national or regional meetings, presentations given at national or regional meetings, or any other product that has been supported by the CC Bio INSITES network. If no current products exist, state "none at this time".

List the Presentation/Publication name, the location presented/published, and the date in the following format: *Name1, Location1, Date1; Name2, Location2, Date2* . Feel free to add any additional relevant information.

_____

_____

_____

_____

_____

Q50 *If you have taken a previous survey for CC Bio INSITES, we already have your personal information (your institution, position, racial and gender identities, etc.) recorded. Please select one of the options below to either skip to the end of the survey or provide us with updated personal information.*

○ I have NOT ever previously taken a survey for CC Bio INSITES (1)

○ I have taken previous CC Bio INSITES surveys and I have new personal information to report (2)

○ I have taken previous CC Bio INSITES surveys and my personal information has NOT changed (skip to end) (4)

Q51 The following questions ask about your professional demographics (e.g., your institution, job title, and the classes you teach). If you prefer not to respond, write NA.

Q52 What is the name and location of your current institution (ex. University of Colorado, Boulder, CO)?

_____

Q53 What is your job title?

_____

_____

_____

_____

_____

Q54 What department(s) are you in?

_____

Q55 What are the primary courses that you teach? Select all that apply.

☐ General Biology for Majors (1)

☐ General Biology for Nonmajors (2)

☐ Cell and Molecular Biology (3)

☐ Organismal Biology (4)

☐ Ecology (5)

☐ Evolution (6)

☐ Microbiology (7)

☐ Anatomy (8)

☐ Physiology (9)

☐ Human Biology (10)

☐ Marine Biology (11)

☐ Botany / Plant Biology (12)

☐ Genetics (13)

☐ Not Presently Teaching (14)

☐ Other (15) _____

☐ I prefer not to respond (16)

Q56 Are you employed part-time or full-time at your institution(s)?

○ Part-time (1)

○ Full-time (2)

○ Other (3) _____

○ I prefer not to respond (4)

Q57 How many years of college or university teaching experience do you have?

Q58
Which of the following degrees have you received? Select all that apply.

☐ Bachelor's degree (4)

☐ Master's degree (5)

☐ PhD (6)

☐ EdD (8)

☐ Other (1) _____

Q59 We have the most profound appreciation and respect for the backgrounds, identities, experiences, and aspirations of our CC Bio INSITES colleagues. Though the demographic information below only gives us a small glimpse into those aspects of your life, it will help us ensure we serve all of our CC Bio INSITES colleagues in an equitable manner.

Q60 Please enter your race(s) and or ethnicity(ies)?

_____

Q61 Please enter your gender.

_____

Q62 Do you identify as the first in your family to go to college?

○ Yes (1)

○ No (2)

○ Other (3) _____

Q63 Please enter the year you were born.

_____

Evidence of reliability for the sense of belonging scales

Supplemental Table 1: Cronbach's alpha scores for sense of belonging to assess instrument's internal consistency reliability.

Timepoint (year)	INSITES Sense of Belonging	BER Sense of Belonging
2018	0.97	0.93
2019	0.90-0.98	0.96
2020	0.94-0.96	0.88-0.95
2021	0.95	0.91-0.96

Evidence of validity and reliability for the self-efficacy scale

Below we describe the additional steps we took to explore the validity and dimensionality of these locally developed items:

We have evidence that the community of CC BER scholars is very small (Lo et al., 2019; Schinske et al., 2017). Therefore, collecting data for and performing factor analyses was unlikely to provide sufficient sample size to adequately test the dimensionality of our measure of BER self-efficacy. Given this, we opted to take a different approach that emphasized cognitive interviews (CIs) and individual CC faculty's understanding and categorization of the items into BER self-efficacy subgroups. Cognitive interviews (CIs) are a type of qualitative data collection in which survey questions are administered to a small sample of the intended target audience, while additional verbal information on the survey responses are collected (Beatty and Willis, 2007). CIs are often used to help evaluate the quality of the response, identify if participants are understanding the survey items, and determine whether the items are generating the information that its author intends (Beatty and Willis, 2007). CIs are prominent methods for identifying and correcting problems with survey questions (Beatty and Willis, 2007). In our study, we used CIs to provide evidence of *process response validity* (American Educational Research Association, American Psychological Association, and National Council on Measurement in Education [AERA et al.], 2014) of our 24 author-created questions measuring CC faculty's self-efficacy in participating in Biology Education Research.

Eleven CC faculty outside of the CC Bio INSITES network volunteered to participate in the CIs. These CCF were snowball sampled through recommendations from network members. CCF were from 10 different community colleges across the United States, all within STEM departments, who ranged in familiarity with BER practices; some actively publishing in BER while others following BER literature. CIs were given a pre-interview activity, where they were

asked to sort all the BER self-efficacy items into 8 categories. The categories were generated by the authors when writing the questions and questions were written to potentially fit into each category: 1) Participating in others' BER, 2) Collecting BER data, 3) Analyzing BER data, 4) Communicating results from BER studies, 5) Getting funding, 6) Implementing evidence-based practices, 7) Designing a BER study, and 8) Other (see Supplemental Materials below for complete CI protocol). The Other category was provided to participants if they were unable to bin the item into one of the other predetermined groups. During the interviews, we employed a think-aloud protocol where our eleven participants were asked to interpret how they understood the wording of each of the items and explained why they binned each item into their chosen category. CI participants could change their categorization during the interview upon further clarification of items if needed. CIs lasted up to 1 hour and were conducted virtually by M.M.C.M. After interviews, a $10 Amazon gift card was provided as a small compensation.

Results of CI revealed that a majority of CCF agreed with how most items fell in the 7 predetermined categories of BER self-efficacy (See further below for CI results). Questions where CCF binned an item into several different categories were removed from further analysis (items 2, 15, 24). Item removals led to Categories 1 and 6 (Participating in others' BER, and Implementing evidence-based practices, respectively) also being left out of further analysis due to having non-unanimous items in the subgroup. Category 5 (Getting Funding) was also left out of analysis because CI interviewees and the research team agreed that the topic was shaped by the availability of institutional resources, rather than one's BER self-efficacy. In sum, Categories 2, 3, 4, and 7 were kept. In conclusion, the BER self-efficacy scale calculation was an average of the average of the final 4 final subscales: 2) Collecting BER data, 3) Analyzing BER data, 4) Communicating results from BER studies, and 7) Designing a BER study (**Supplemental Figure 1**).
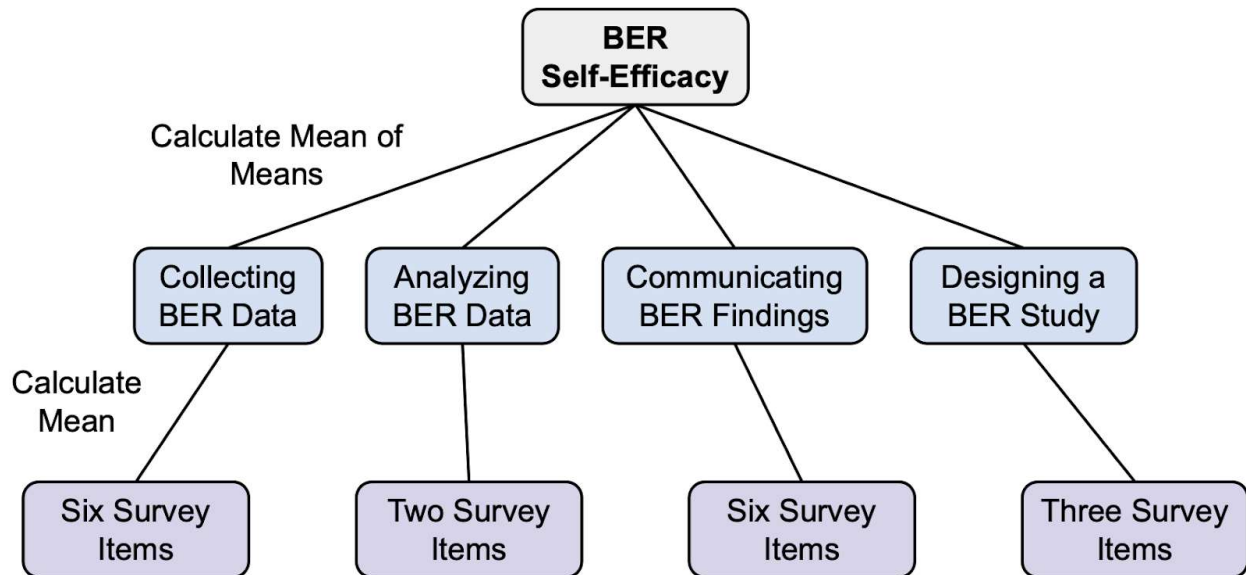
Supplemental Figure 1: Depiction of the items measuring four constructs related to BER self-efficacy, including collecting BER data, analyzing BER data, communication BER findings, and designing a BER study. Each of these constructs had more than one item contributing to its measurement.

Evidence of Reliability for the Self-efficacy Scale.

As with sense of belonging, internal consistency was also calculated as a measure of reliability for our BER self-efficacy scale per year of the survey responses. Across years, internal consistency of the BER self-efficacy categories were established with Cronbach alphas scores ranging from 0.54-0.96 (see Supplemental Table 2). Category 3, analyzing BER data, was the only category with lower Cronbach's alpha scores (<0.7). In this category we ask participants about their self-efficacy in analyzing data using quantitative and qualitative approaches. As such, an individual who may have high self-efficacy in one approach, does not necessitate a high proficiency and self-efficacy in the other, therefore, making the construct items not always correlated. Despite lower reliability within analyzing BER data, we chose to keep the category for the purposes of measuring overall self-efficacy in participating or conducting BER. We were unable to run multi-group CFA with observations grouped by time due to small sample sizes (as low as 19 observations per group).

Supplemental Table 2: Cronbach's alpha scores for BER self-efficacy to assess its internal consistency reliability.

Timepoint (year)	2) Collecting BER data	3) Analyzing BER data	4) Communicating results from BER studies	7) Designing a BER study
2018	0.90	0.77	0.94	0.83
2019	0.90-0.91	0.54-0.69	0.92-0.94	0.82
2020	0.84-0.87	0.60-0.64	0.91-0.92	0.83-0.85
2021	0.87-0.90	0.73-0.82	0.94-0.96	0.87-0.88

Cognitive Interview Protocol

PART 1: Sorting *(To be given BEFORE the interview)*

The purpose of this interview is to ascertain how certain survey questions related to confidence in conducting Biology Education Research (BER) may be categorized together. We would appreciate your feedback in binning the following prompts (next page) into 7 mutually exclusive categories. The 6 categories and their definitions are as follows:

Category	1) Participating in others' BER	2) Collecting BER data	3) Analyzing BER data	4) Communicating results from BER studies	5) Getting funding	6) Implementing evidence-based practices	7) Other
Definition	Instances in which you are asked to participate in someone else's study.	Instances in which you gather data/information that will inform the claims made in a BER project.	Instances in which you quantitatively or qualitatively analyze data.	Instances where you share BER results from analyses e.g. conference posters, presentations, publications.	Instances where you seek out funding for BER projects e.g. writing proposals.	Instances where you seek out BER literature to improve your pedagogy.	*Please describe what you bin as "Other" in the table below. Feel free to add further details after the table.*

Before our scheduled time to meet, please mark with an **X** where you categorize the following 24 prompts within this GoogleDoc. If you find a prompt does not fit into one of these categories, please place it under the "Other" bin, and describe why you designated that item in this way (e.g. add what category that prompt would fall under). If you have another category you might suggest we include, please describe that category. The overarching prompt that precedes these questions is ***"How confident are you in your ability to perform the following tasks?"***

	1	2	3	4	5	6	7
This is an EXAMPLE							**X** This prompt describes more like ___ in BER
1. Implement evidence-based practices in biology instruction (e.g. active learning)							
2. Read and understand biology education research papers							
3. Use pre/post tests of your own design to collect evidence of student outcomes							
4. Use published pre/post tests of other's design to collect evidence of student outcomes							
5. Use surveys of your own design to collect information about student learning, affect or behavior							
6. Use published surveys of other's design to collect information about student learning, affect or behavior							
7. Participate in other people's biology							

education research projects							
8. Generate biology education research questions of interest to you							
9. Design my own biology education research study							
10. Write an IRB for my own study or collaborate on an IRB for someone else's study							
11. Collect quantitative evidence (e.g., likert-like survey data, numeric data) for biology education research							
12. Collect qualitative evidence (e.g., essays, interviews, or focus groups) for biology education research							
13. Perform statistical analyses for biology education research							
14. Perform qualitative analyses in the area of biology education research							
15. Include ways to account for differences among participants when designing your own biology education research							
16. Discuss biology education evidence you collected with other colleagues in your department or at your institution							
17. Discuss biology education evidence you collected with other colleagues outside of your institution							

18. Present a poster or give a talk at your institution on evidence you collected regarding biology education							
19. Present a poster or give a talk outside of your institution on evidence you collected regarding biology education.							
20. Publish biology education research in non-peer-reviewed venues.							
21. Publish biology education research in peer-reviewed venues.							
22. Speak with funding agency representatives regarding biology education research							
23. Write successful grant proposals to support biology education research							
24. Serve as a peer-reviewer for biology education research journals							

If needed, please further describe your "Other" categories below:

PART 2: Justifying, Probing, and Clarifying *(during the interview)*

The purpose of this interview is to ascertain how certain survey questions related to confidence may be categorized together and to probe how CC instructors may interpret these questions. With your permission, this interview will be Zoom recorded. We anticipate this interview to be ~1 hour. After interviews, we will provide a small token of appreciation through a $10 Amazon gift card. Any questions?

Let's start by looking at the way you've understood the categories. Let's start with the first category.
1. What does the category mean to you?
2. Was there anything unclear in the language?
3. Is there anything you would change about it?

We are now going to talk about each prompt individually. I will read this question and prompt... *(Go through each topic and ask the following questions)*

1. Tell me why you binned or categorized these prompts in this way. *(Go through their thoughts on each category and what fits under each category)*
2. What does this prompt mean to you? Does that make sense to you? *(how they interpret the question)*
3. Do you find this prompt clear?
    3.1. *(if a participant hesitates or you see participant confusion over verbiage, ask)* Tell me more about that word.
4. Is there anything you would change in the way we've asked this prompt?
5. Does it make sense to respond to this prompt on a scale of Not at all Confident, Somewhat Confident, Confident, Highly Confident, Absolutely Confident (5 Likert-scale)? *(We also provided I Don't Know and I Prefer Not to Respond options)*

Logistically:
6. What is your best email for the Amazon gift card to be sent? Thank you for participating in the CC Bio INSITES cognitive interviews!

Cognitive Interview Results

Supplemental Table 2: Validity results of the BER confidence scale from cognitive interviews (n = 11). For each prompt is the number of interviewees who reported where each prompt falls in the predefined categories. Based on the results, questions 2, 15, and 24 were removed (in red text) and Categories 2,3,4, and 7 were kept for further analysis.

Question Number	Prompt	1) Participating in others' BER	2*) Collecting BER data	3*) Analyzing BER data	4*) Communicating results from BER studies	5) Getting funding	6) Implementing evidence-based practices	7*) Designing a BER study	8) Other
1	Implement evidence-based practices in biology instruction (e.g. active learning)						11		
2	Read and understand biology education research papers			1			6	3	1
3	Use pre/post tests of your own design to collect evidence of student outcomes		10					1	
4	Use published pre/post tests of other's design to collect evidence of student outcomes		9				1	1	
5	Use surveys of your own design to collect information about student learning, affect or behavior		11						
6	Use published surveys of other's design to collect information about student learning, affect or behavior		11						
7	Participate in other people's biology education research projects	11							

#	Item							
8	Generate biology education research questions of interest to you						11	
9	Design my own biology education research study						11	
10	Write an IRB for my own study or collaborate on an IRB for someone else's study						11	
11	Collect quantitative evidence (e.g., likert-like survey data, numeric data) for biology education research		11					
12	Collect qualitative evidence (e.g., essays, interviews, or focus groups) for biology education research		11					
13	Perform statistical analyses for biology education research			11				
14	Perform qualitative analyses in the area of biology education research			11				
15	Include ways to account for differences among participants when designing/analyzing your own biology education research			3			8	
16	Discuss biology education evidence you collected with other colleagues in your department or at your institution				11			
17	Discuss biology education evidence you collected with other colleagues outside of your institution				11			
18	Present a poster or give a talk at your institution on evidence you collected regarding biology education				11			

#	Statement							
19	Present a poster or give a talk outside of your institution on evidence you collected regarding biology education.				11				
20	Publish biology education research in non-peer-reviewed venues.				11				
21	Publish biology education research in peer-reviewed venues.				11				
22	Speak with funding agency representatives regarding biology education research					11			
23	Write successful grant proposals to support biology education research					11			
24	Serve as a peer-reviewer for biology education research journals	2			4		1		4

Descriptive Statistics of Connectivity, Self-efficacy, and Belonging

Descriptive Statistics

Degrees of Connectivity and Centrality Measures

Measures of node degree, betweenness centrality, and closeness centrality were calculated as metrics of social networks. Node degree measures ranged from 1 to 106 with a mean of 19 and a median of 11. Betweenness centrality measures ranged from 0 to 1284.23 with a mean of 33.41 and a median of 2.13. Lastly, closeness centrality measures ranged from 0.004 to 0.016 with a mean of 0.0076 and a median of 0.0072.

Self-efficacy

Responses on self-efficacy items ranged in value from 1 to 5. From 2018-2021, mean values for the items ranged from 2.53 to 3.86. All items had a skewness below |0.6|. All items had a kurtosis below |1.1|. One item was missing 4% of its responses (Conf_PubGeneral), but all other items were missing 1% or less. Missing data was random. A total of six individual participant responses were missing too many survey items (>33%) in a particular construct, leading to an NA value.

INSITES and BER Belonging

Survey responses were filtered to remove those missing more than 20% of the items, leaving 267 observations. Items for INSITES sense of belonging ranged in value from 1 to 5, while items for the broader BER community sense of belonging ranged from 2 to 5. Mean values for the items pertaining to INSITES belonging ranged from 4.35 to 4.47, while the mean values for BER belonging items ranged from 3.92 to 3.97. All items had a skewness below |1.5|. All items had a kurtosis below |2.5|. A total of two individual participant responses were missing too many survey items (>33%) in a particular construct, leading to an NA value. All items were missing 1% or less responses after the initial filtering step.

Mixed Linear Model of INSITES Belonging

As reported in the manuscript, standardized coefficients revealed that CCF with more connections to other CCFs had a higher sense of belonging within the network (**Supplemental Figure 2**). Also, CCF had a greater sense of belonging over the time in the program. However, multicollinearity metrics (variance inflation factors; VIF) indicated there was high collinearity between the time and social network variables. Collinearity describes the phenomenon when two predictors correlate such that they themselves demonstrate a linear relationship. In these cases, the predictors do not serve as independent variables to predict our outcome of interest and their associated coefficients will have inaccurate statistical significance. To address this collinearity, we attempted two separate approaches. First, we trained separate models wherein we removed one of the highly collinear features at a time. However, while this addressed the collinearity, it led to loss of any other significant variables except for an earlier time point in the program where sense of belonging was negatively affected. Second, we trained a generalized linear mixed model using least absolute shrinkage and selection operator (LASSO), a method that is more tolerant of highly collinear variables. LASSO models impose a set penalty on the predictor coefficients while optimizing these coefficients for the lowest prediction error. As such, LASSO model training still tries to train an accurate and informative model while simultaneously encouraging all coefficients to be as low as possible, thus helping to combat though not fully address the inflation effects of collinearity. LASSO models must be trained with varying values of penalty, i.e., lambda values, to determine an appropriate penalty value that minimizes the error. Generally speaking, the lambda value that minimizes the error or the lowest possible penalty within a standard error of this minimized error is an acceptable choice for the LASSO model. However, once we trained both these LASSO models with both 1) the minimal possible error and 2) a low error, but also low penalty value, neither model had significant model coefficients beyond the early time point mentioned above. Taken together, we concluded that our data set at present does not allow training and interpretation of a linear mixed model to address this initial research question. Thus, in pivoting to use descriptive statistics and visualization (**Figure 3**), we see that generally higher numbers of connections positively correlate with higher sense of belonging at all later time points. The significance of these weak correlations is such that we cannot say that connectivity causes increased belonging, but the two features are related within our population.
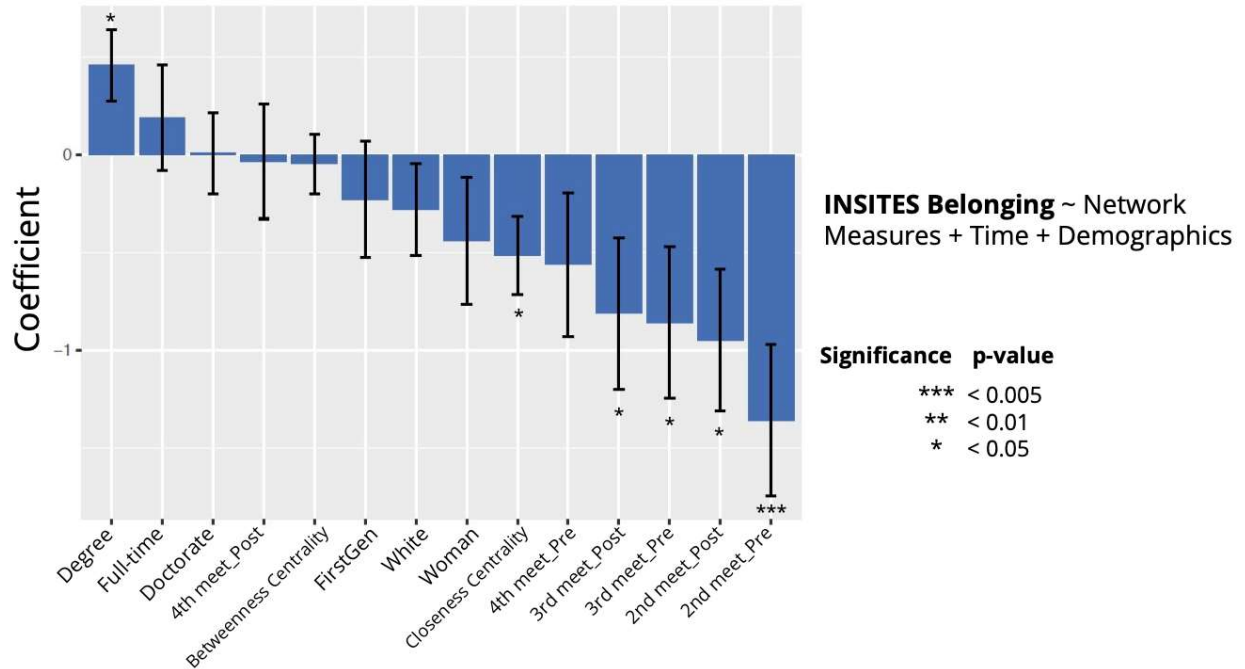
Supplemental Figure 2: Mixed linear model predicting the variation in a CCF's sense of belonging to the smaller INSITES community. The most important fixed effect included number of connections (degree) and time. Multiple responses by participants over time were accounted for as the random effect. The full model was: INSITESBelongScore ~ Race + FirstGen + FullTime + Doctorate + Gender + Degree + Closeness Centrality + Betweenness Centrality + Time. This model was not included in the main manuscript due to high multicollinearity detected between some independent variables.

Tables of Research Question 2 & 3 (Figures 6 & 7) Data