

COVER SHEET FOR PROPOSAL TO THE NATIONAL SCIENCE FOUNDATION

PROGRAM ANNOUNCEMENT/SOLICITATION NO./DUE DATE NSF 15-509 09/14/17		<input type="checkbox"/> Special Exception to Deadline Date Policy			FOR NSF USE ONLY
FOR CONSIDERATION BY NSF ORGANIZATION UNIT(S) (Indicate the most specific unit known, i.e. program, division, etc.) HRD - Core R&D Programs					NSF PROPOSAL NUMBER 1747580
DATE RECEIVED 06/19/2017	NUMBER OF COPIES 1	DIVISION ASSIGNED 11060000 HRD	FUND CODE 7980	DUNS# (Data Universal Numbering System) 614209054	FILE LOCATION 07/18/2017 4:35pm S
EMPLOYER IDENTIFICATION NUMBER (EIN) OR TAXPAYER IDENTIFICATION NUMBER (TIN) 060772160		SHOW PREVIOUS AWARD NO. IF THIS IS <input type="checkbox"/> A RENEWAL <input type="checkbox"/> AN ACCOMPLISHMENT-BASED RENEWAL		IS THIS PROPOSAL BEING SUBMITTED TO ANOTHER FEDERAL AGENCY? YES <input type="checkbox"/> NO <input checked="" type="checkbox"/> IF YES, LIST ACRONYM(S)	
NAME OF ORGANIZATION TO WHICH AWARD SHOULD BE MADE University of Connecticut			ADDRESS OF AWARDEE ORGANIZATION, INCLUDING 9 DIGIT ZIP CODE University of Connecticut 438 Whitney Road Ext. Storrs, CT. 062691133		
AWARDEE ORGANIZATION CODE (IF KNOWN) 0014175000					
NAME OF PRIMARY PLACE OF PER University of Connecticut			ADDRESS OF PRIMARY PLACE OF PER, INCLUDING 9 DIGIT ZIP CODE University of Connecticut 354 Mansfield Road Storrs ,CT ,062691176 ,US.		
IS AWARDEE ORGANIZATION (Check All That Apply)		<input type="checkbox"/> SMALL BUSINESS <input type="checkbox"/> FOR-PROFIT ORGANIZATION		<input type="checkbox"/> MINORITY BUSINESS <input type="checkbox"/> WOMAN-OWNED BUSINESS <input type="checkbox"/> IF THIS IS A PRELIMINARY PROPOSAL THEN CHECK HERE	
TITLE OF PROPOSED PROJECT EAGER: Collaborative Research: Exploring the Effects of Academic Climate and Social Networks on the Persistence of Sexual and Gender Minority STEM Undergraduates					
REQUESTED AMOUNT \$ 173,989	PROPOSED DURATION (1-60 MONTHS) 24 months		REQUESTED STARTING DATE 09/01/17	SHOW RELATED PRELIMINARY PROPOSAL NO. IF APPLICABLE	
THIS PROPOSAL INCLUDES ANY OF THE ITEMS LISTED BELOW					
<input type="checkbox"/> BEGINNING INVESTIGATOR <input type="checkbox"/> DISCLOSURE OF LOBBYING ACTIVITIES <input type="checkbox"/> PROPRIETARY & PRIVILEGED INFORMATION <input type="checkbox"/> HISTORIC PLACES <input type="checkbox"/> VERTEBRATE ANIMALS IACUC App, Date _____ PHS Animal Welfare Assurance Number _____ <input checked="" type="checkbox"/> TYPE OF PROPOSAL EAGER					
PI/PD DEPARTMENT Anthropology		PI/PD POSTAL ADDRESS 354 Mansfield Road			
PI/PD FAX NUMBER		Storrs, CT 062691176 United States			
NAMES (TYPED)	High Degree	Yr of Degree	Telephone Number	Email Address	
PI/PD NAME Chrystal Smith	PhD	2009	860-486-2137	chrystal.smith@uconn.edu	
CO-PI/PD					

CERTIFICATION PAGE

Certification for Authorized Organizational Representative (or Equivalent) or Individual Applicant

By electronically signing and submitting this proposal, the Authorized Organizational Representative (AOR) or Individual Applicant is: (1) certifying that statements made herein are true and complete to the best of his/her knowledge; and (2) agreeing to accept the obligation to comply with NSF award terms and conditions if an award is made as a result of this application. Further, the applicant is hereby providing certifications regarding conflict of interest (when applicable), drug-free workplace, debarment and suspension, lobbying activities (see below), nondiscrimination, flood hazard insurance (when applicable), responsible conduct of research, organizational support, Federal tax obligations, unpaid Federal tax liability, and criminal convictions as set forth in the NSF Proposal & Award Policies & Procedures Guide (PAPPG). Willful provision of false information in this application and its supporting documents or in reports required under an ensuing award is a criminal offense (U.S. Code, Title 18, Section 1001).

Certification Regarding Conflict of Interest

The AOR is required to complete certifications stating that the organization has implemented and is enforcing a written policy on conflicts of interest (COI), consistent with the provisions of PAPPG Chapter IX.A.; that, to the best of his/her knowledge, all financial disclosures required by the conflict of interest policy were made; and that conflicts of interest, if any, were, or prior to the organization's expenditure of any funds under the award, will be, satisfactorily managed, reduced or eliminated in accordance with the organization's conflict of interest policy. Conflicts that cannot be satisfactorily managed, reduced or eliminated and research that proceeds without the imposition of conditions or restrictions when a conflict of interest exists, must be disclosed to NSF via use of the Notifications and Requests Module in FastLane.

Drug Free Work Place Certification

By electronically signing the Certification Pages, the Authorized Organizational Representative (or equivalent), is providing the Drug Free Work Place Certification contained in Exhibit II-3 of the Proposal & Award Policies & Procedures Guide.

Debarment and Suspension Certification

(If answer "yes", please provide explanation.)

Is the organization or its principals presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from covered transactions by any Federal department or agency?

Yes

No

By electronically signing the Certification Pages, the Authorized Organizational Representative (or equivalent) or Individual Applicant is providing the Debarment and Suspension Certification contained in Exhibit II-4 of the Proposal & Award Policies & Procedures Guide.

Certification Regarding Lobbying

This certification is required for an award of a Federal contract, grant, or cooperative agreement exceeding \$100,000 and for an award of a Federal loan or a commitment providing for the United States to insure or guarantee a loan exceeding \$150,000.

Certification for Contracts, Grants, Loans and Cooperative Agreements

The undersigned certifies, to the best of his or her knowledge and belief, that:

- (1) No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.
- (2) If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form-LLL, "Disclosure of Lobbying Activities," in accordance with its instructions.
- (3) The undersigned shall require that the language of this certification be included in the award documents for all subawards at all tiers including subcontracts, subgrants, and contracts under grants, loans, and cooperative agreements and that all subrecipients shall certify and disclose accordingly.

This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by section 1352, Title 31, U.S. Code. Any person who fails to file the required certification shall be subject to a civil penalty of not less than \$10,000 and not more than \$100,000 for each such failure.

Certification Regarding Nondiscrimination

By electronically signing the Certification Pages, the Authorized Organizational Representative (or equivalent) is providing the Certification Regarding Nondiscrimination contained in Exhibit II-6 of the Proposal & Award Policies & Procedures Guide.

Certification Regarding Flood Hazard Insurance

Two sections of the National Flood Insurance Act of 1968 (42 USC §4012a and §4106) bar Federal agencies from giving financial assistance for acquisition or construction purposes in any area identified by the Federal Emergency Management Agency (FEMA) as having special flood hazards unless the:

- (1) community in which that area is located participates in the national flood insurance program; and
- (2) building (and any related equipment) is covered by adequate flood insurance.

By electronically signing the Certification Pages, the Authorized Organizational Representative (or equivalent) or Individual Applicant located in FEMA-designated special flood hazard areas is certifying that adequate flood insurance has been or will be obtained in the following situations:

- (1) for NSF grants for the construction of a building or facility, regardless of the dollar amount of the grant; and
- (2) for other NSF grants when more than \$25,000 has been budgeted in the proposal for repair, alteration or improvement (construction) of a building or facility.

Certification Regarding Responsible Conduct of Research (RCR)

(This certification is not applicable to proposals for conferences, symposia, and workshops.)

By electronically signing the Certification Pages, the Authorized Organizational Representative is certifying that, in accordance with the NSF Proposal & Award Policies & Procedures Guide, Chapter IX.B. , the institution has a plan in place to provide appropriate training and oversight in the responsible and ethical conduct of research to undergraduates, graduate students and postdoctoral researchers who will be supported by NSF to conduct research. The AOR shall require that the language of this certification be included in any award documents for all subawards at all tiers.

CERTIFICATION PAGE - CONTINUED

Certification Regarding Organizational Support

By electronically signing the Certification Pages, the Authorized Organizational Representative (or equivalent) is certifying that there is organizational support for the proposal as required by Section 526 of the America COMPETES Reauthorization Act of 2010. This support extends to the portion of the proposal developed to satisfy the Broader Impacts Review Criterion as well as the Intellectual Merit Review Criterion, and any additional review criteria specified in the solicitation. Organizational support will be made available, as described in the proposal, in order to address the broader impacts and intellectual merit activities to be undertaken.

Certification Regarding Federal Tax Obligations

When the proposal exceeds \$5,000,000, the Authorized Organizational Representative (or equivalent) is required to complete the following certification regarding Federal tax obligations. By electronically signing the Certification pages, the Authorized Organizational Representative is certifying that, to the best of their knowledge and belief, the proposing organization:

- (1) has filed all Federal tax returns required during the three years preceding this certification;
- (2) has not been convicted of a criminal offense under the Internal Revenue Code of 1986; and
- (3) has not, more than 90 days prior to this certification, been notified of any unpaid Federal tax assessment for which the liability remains unsatisfied, unless the assessment is the subject of an installment agreement or offer in compromise that has been approved by the Internal Revenue Service and is not in default, or the assessment is the subject of a non-frivolous administrative or judicial proceeding.

Certification Regarding Unpaid Federal Tax Liability

When the proposing organization is a corporation, the Authorized Organizational Representative (or equivalent) is required to complete the following certification regarding Federal Tax Liability:

By electronically signing the Certification Pages, the Authorized Organizational Representative (or equivalent) is certifying that the corporation has no unpaid Federal tax liability that has been assessed, for which all judicial and administrative remedies have been exhausted or lapsed, and that is not being paid in a timely manner pursuant to an agreement with the authority responsible for collecting the tax liability.

Certification Regarding Criminal Convictions

When the proposing organization is a corporation, the Authorized Organizational Representative (or equivalent) is required to complete the following certification regarding Criminal Convictions:

By electronically signing the Certification Pages, the Authorized Organizational Representative (or equivalent) is certifying that the corporation has not been convicted of a felony criminal violation under any Federal law within the 24 months preceding the date on which the certification is signed.

Certification Dual Use Research of Concern

By electronically signing the certification pages, the Authorized Organizational Representative is certifying that the organization will be or is in compliance with all aspects of the United States Government Policy for Institutional Oversight of Life Sciences Dual Use Research of Concern.

AUTHORIZED ORGANIZATIONAL REPRESENTATIVE	SIGNATURE	DATE
NAME MiChelle D Pereira Lopes	Electronic Signature	Jun 19 2017 11:38AM
TELEPHONE NUMBER	EMAIL ADDRESS	FAX NUMBER
860-486-6008	preaward@uconn.edu	860-486-3726

COVER SHEET FOR PROPOSAL TO THE NATIONAL SCIENCE FOUNDATION

PROGRAM ANNOUNCEMENT/SOLICITATION NO./DUE DATE NSF 15-509 09/14/17		<input type="checkbox"/> Special Exception to Deadline Date Policy			FOR NSF USE ONLY
FOR CONSIDERATION BY NSF ORGANIZATION UNIT(S) (Indicate the most specific unit known, i.e. program, division, etc.) HRD - Core R&D Programs					NSF PROPOSAL NUMBER 1747583
DATE RECEIVED	NUMBER OF COPIES	DIVISION ASSIGNED	FUND CODE	DUNS# (Data Universal Numbering System)	FILE LOCATION
06/19/2017	1	11060000 HRD	7980	069687242	07/18/2017 4:36pm S
EMPLOYER IDENTIFICATION NUMBER (EIN) OR TAXPAYER IDENTIFICATION NUMBER (TIN) 593102112		SHOW PREVIOUS AWARD NO. IF THIS IS <input type="checkbox"/> A RENEWAL <input type="checkbox"/> AN ACCOMPLISHMENT-BASED RENEWAL		IS THIS PROPOSAL BEING SUBMITTED TO ANOTHER FEDERAL AGENCY? YES <input type="checkbox"/> NO <input checked="" type="checkbox"/> IF YES, LIST ACRONYM(S)	
NAME OF ORGANIZATION TO WHICH AWARD SHOULD BE MADE University of South Florida			ADDRESS OF AWARDEE ORGANIZATION, INCLUDING 9 DIGIT ZIP CODE University of South Florida 3702 Spectrum Blvd. Tampa, FL 336129446		
AWARDEE ORGANIZATION CODE (IF KNOWN) 0015370000					
NAME OF PRIMARY PLACE OF PERIODIC REPORTING University of South Florida			ADDRESS OF PRIMARY PLACE OF PERIODIC REPORTING, INCLUDING 9 DIGIT ZIP CODE University of South Florida FL ,336129446 ,US.		
IS AWARDEE ORGANIZATION (Check All That Apply)		<input type="checkbox"/> SMALL BUSINESS <input type="checkbox"/> FOR-PROFIT ORGANIZATION		<input type="checkbox"/> MINORITY BUSINESS <input type="checkbox"/> WOMAN-OWNED BUSINESS <input type="checkbox"/> IF THIS IS A PRELIMINARY PROPOSAL THEN CHECK HERE	
TITLE OF PROPOSED PROJECT EAGER: Collaborative Research: Exploring the Effects of Academic Climate and Social Networks on the Persistence of Sexual and Gender Minority STEM Undergraduates					
REQUESTED AMOUNT \$ 126,010	PROPOSED DURATION (1-60 MONTHS) 24 months		REQUESTED STARTING DATE 09/01/17	SHOW RELATED PRELIMINARY PROPOSAL NO. IF APPLICABLE	
THIS PROPOSAL INCLUDES ANY OF THE ITEMS LISTED BELOW					
<input type="checkbox"/> BEGINNING INVESTIGATOR		<input checked="" type="checkbox"/> HUMAN SUBJECTS		Human Subjects Assurance Number FWA00001669	
<input type="checkbox"/> DISCLOSURE OF LOBBYING ACTIVITIES		Exemption Subsection _____		or IRB App. Date Pending	
<input type="checkbox"/> PROPRIETARY & PRIVILEGED INFORMATION		<input type="checkbox"/> INTERNATIONAL ACTIVITIES: COUNTRY/COUNTRIES INVOLVED _____			
<input type="checkbox"/> HISTORIC PLACES		<input type="checkbox"/> COLLABORATIVE STATUS			
<input type="checkbox"/> VERTEBRATE ANIMALS IACUC App. Date _____ PHS Animal Welfare Assurance Number _____		A collaborative proposal from multiple organizations (PAPPG II.D.3.b)			
PI/PD DEPARTMENT Women's and Gender Studies		PI/PD POSTAL ADDRESS 3650 Spectrum Blvd Suite 160 Tampa, FL 336129446 United States			
PI/PD FAX NUMBER					
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CO-PI/PD					
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- (2) If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form-LLL, "Disclosure of Lobbying Activities," in accordance with its instructions.
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Certification Dual Use Research of Concern

By electronically signing the certification pages, the Authorized Organizational Representative is certifying that the organization will be or is in compliance with all aspects of the United States Government Policy for Institutional Oversight of Life Sciences Dual Use Research of Concern.

AUTHORIZED ORGANIZATIONAL REPRESENTATIVE		SIGNATURE	DATE
NAME Arthur Santos		Electronic Signature	Jun 19 2017 11:49AM
TELEPHONE NUMBER	EMAIL ADDRESS arthursantos@usf.edu		FAX NUMBER

PROJECT SUMMARY

Overview:

Through a theoretical framework of social capital theory, this transformative research explores the effects of academic climate and social networks on the persistence of SGM STEM undergraduates, an understudied population. SGM refers to individuals who identify as Lesbian, Gay, Bisexual, Transgender, or Queer/Questioning (LGBTQ) or other sexual or gender minority positionalities (Shelton, 2017). Persistence is defined uniquely as the presence of academic affirming actions (e.g., enrolling in classes and maintaining a passing GPA) as well as strategic choice activities (e.g., intentionally changing advisors, majors, or institutions) that lead to progress toward students' STEM goals. Academic climate refers to both student perceptions of others' attitudes, behaviors, and practices and student experiences of discrimination, harassment, and abuse. Social networks are relationships that convey useful resources that benefit some majority group members, while groups that are traditional outsiders- such as SGM individuals are less likely to benefit.

Our collaborative exploratory interdisciplinary study addresses the question: How do STEM academic climate and social networks affect the persistence of SGM STEM undergraduates? To increase our understanding about their experiences of STEM academic climate, social networks, and persistence in STEM programs and reconceptualize their persistence as strategic choice, we will use a mixed-methods approach to 1) gather rich in-depth interview data from SGM STEM undergraduates, and 2) develop survey questions from the interview data and relevant literature. We will test the survey on a purposive sample of SGM STEM undergraduates. Our goal is to create a reliable and validated survey that can be used to comparatively study SGM STEM students nationally, across disciplines. Consequently, study participants will be recruited from six STEM-based national professional associations and discipline-specific societies with dedicated SGM subdivisions.

Our semi-structured interviews will be audio-recorded and transcribed, coded in QSR NVivo 11.0, and analyzed using thematic analysis. The preliminary survey will be evaluated using a Think Aloud exercise and then pilot tested. The final survey instrument will be administered using the Qualtrics online platform. We employ ego network analysis, multilevel logistic regression (MLR), and intersectional analysis using SAS 9.4 to analyze the survey results.

Intellectual Merit:

Our study is at the forefront of using interdisciplinary social science theory and methodology to examine the persistence of SGM STEM undergraduates. Our research 1) makes the first significant contribution to STEM higher education literature on SGM STEM undergraduates, an understudied growing population, 2) builds on the few predominantly qualitative previously conducted studies, 3) expands the use of social capital theory to understand the effects of faculty, peer, and social networks on SGM STEM undergraduates, and 4) uses extensive instrument development to construct a reliable and valid survey warranted by the absence of existing surveys that target SGM STEM undergraduates.

Broader Impacts:

Our collaborative, interdisciplinary theory-driven research impacts 1) STEM educators and policymakers by providing preliminary data about the persistence of SGM STEM undergraduates, as related to their experiences of STEM academic climate and social networks. Such data can be used to inform interventions to enhance SGM undergraduates' success in STEM; 2) the six STEM national professional organizations participating in our study, by strengthening their efforts to raise awareness about issues effecting SGM individuals among their professional/faculty/student membership (~70,000 total) through our collaboration with their leadership; and 3) a broader academic audience by disseminating our findings to STEM education researchers, practitioners, policy makers, and the general public.

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Table of Contents	<u>1</u>	
Project Description (Including Results from Prior NSF Support) (not to exceed 15 pages) (Exceed only if allowed by a specific program announcement/solicitation or if approved in advance by the appropriate NSF Assistant Director or designee)	<u>8</u>	
References Cited	<u>4</u>	
Biographical Sketches (Not to exceed 2 pages each)	<u>2</u>	
Budget (Plus up to 3 pages of budget justification)	<u>6</u>	
Current and Pending Support	<u>2</u>	
Facilities, Equipment and Other Resources	<u>2</u>	
Special Information/Supplementary Documents (Data Management Plan, Mentoring Plan and Other Supplementary Documents)	<u>14</u>	
Appendix (List below.) (Include only if allowed by a specific program announcement/ solicitation or if approved in advance by the appropriate NSF Assistant Director or designee)		
Appendix Items:		

*Proposers may select any numbering mechanism for the proposal. The entire proposal however, must be paginated. Complete both columns only if the proposal is numbered consecutively.

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Budget (Plus up to 3 pages of budget justification)	5	_____
Current and Pending Support	2	_____
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Appendix Items:		

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EAGER: Collaborative Research: Exploring the Effects of Academic Climate and Social Networks on the Persistence of Sexual and Gender Minority STEM Undergraduates

Introduction and Significance

Through a theoretical framework of social capital theory, this proposal explores the effects of academic climate and social networks on the persistence of SGM STEM undergraduates. **SGM** refers to individuals who identify as Lesbian, Gay, Bisexual, Transgender, or Queer/Questioning (LGBTQ) or other sexual or gender minority positionalities (Shelton, 2017). **Persistence** is defined uniquely as the presence of academic affirming actions (e.g., enrolling in classes and maintaining a passing GPA) as well as strategic choice activities (e.g., intentionally changing advisors, majors, or institutions) that lead to progress toward students' STEM goals. Our project incorporates students' perspectives of their interactional and structural experiences within STEM that may explain their persistence choices. *The study is designed to gather rich in-depth interview data about SGM undergraduates' experiences with STEM academic climate and the social networks that impact their persistence. We use these data along with relevant literature to develop and test a survey instrument that can be used to comparatively study SGM STEM students nationally, across disciplines.* Our collaborative, mixed-methods exploratory study addresses the question: **How do STEM academic climate and social networks affect the persistence of SGM STEM undergraduates?** After this study and with the support of additional NSF funding, we intend to administer the resulting reliable and valid survey to a representative national sample of SGM undergraduates across STEM disciplines.

Because the extant literature notes very little about the perceptions and experiences of SGM STEM students, existing theoretical, methodological, and substantive frameworks and instruments may not be fully applicable to this population. Moreover, the research on SGM STEM students contains significant gaps, making our project an ideal study through the EAGER program as it aligns with the program's emphasis on exploratory and potentially transformative research.

We are guided in this research by our previous NSF-funded research (*The Effects of Social Capital and Cultural Models on the Retention and Degree Attainment of Women and Minority Engineering Undergraduates* (SCCM) (#1432297, PI Kersaint); existing literature about SGM students and their campus academic climate experiences; and our theoretical framework of social capital, which focuses on the concept of social networks.

Intellectual Merit. Our study is at the forefront of using interdisciplinary social science theory and methodology to examine the persistence of SGM STEM undergraduates. Our research 1) makes the first significant contribution to STEM higher education literature on SGM STEM undergraduates, an understudied growing population, 2) builds on the few predominantly qualitative previously conducted studies, 3) expands the use of social capital theory to understand the effects of faculty, peer, and social networks on SGM STEM undergraduates, and 4) uses extensive instrument development to construct a reliable and valid survey warranted by the absence of existing surveys that target SGM STEM undergraduates.

Campus and Academic Climate, Intersectionality and SGM Students

While the proportion of STEM students who identify as SGM is still unknown, we do know that individuals are openly questioning their gender identities at younger ages (Kosciw, Greytak, Palmer, & Boesen, 2015) and that the number of undergraduates who openly identify as SGM continues to grow (Berila, 2011; Stewart & Howard-Hamilton, 2015). **Academic climate** refers to both psychological climate (student perceptions of others' attitudes, behaviors, and practices) and experiential climate (student experiences of discrimination, harassment, and abuse) (Woodford & Kulick, 2015). Studies on university academic climate suggest that SGM students still experience significant harassment, discrimination, and exclusion (Garvey & Rankin, 2015), and SGM students are at the "highest risk for experiencing conduct that interferes with their ability to live and learn on campus" (p. 11).

Not only is there a dearth of research on the experiences of SGM undergraduates majoring in STEM programs, but the research that does exist tends to be qualitative and predominantly in engineering (see e.g. Cooper & Brownell, 2016; Hughes, 2017). Trenshaw and colleagues (2013), for instance, found that 16 LGBT participants in their study perceived the engineering academic culture as heteronormative, generally unsupportive, and exclusionary. Cech and Waidzunas' (2011) qualitative study of the cultural norms in engineering programs concluded that the efforts required by LGBTQ students to navigate engineering programs' heteronormative climate (e.g., passing, living compartmentalized lives, and isolating oneself from engineering peers) entail a tremendous amount of emotional work and can "limit these students' opportunities to succeed, relative to their heterosexual peers" as well as create perceptions of oppressive department climates (p. 1). Classroom interactions can be particularly fraught (Cooper & Brownell, 2016); for instance, transgender students report faculty refusal to use appropriate pronouns in a direct address can lead to student disengagement from courses (Pryor, 2015).

At the same time, SGM STEM students, like all students, are not solely defined by their SGM identities. **Intersectionality** recognizes that students simultaneously hold multiple positionalities, such as race, class, gender and sexuality (Crenshaw, 2003). A small number of recent SGM climate studies (e.g. Yost & Gilmore, 2011) address the effects of intersectionality on students' experiences of campus climate. For instance, in engineering, Cech and Waidzunas (2011) focused on multiple marginalized identities (e.g., racial identity and sexuality identity) and the ways those multiple marginalized identities affected how students experienced their programs.

Social Capital Theory, Social Networks and SGM STEM Students

To our knowledge, social capital theory and social networks have not been tested on an SGM STEM population, though SGM students were likely included in prior research. This is a significant gap, as Longerbeam and colleagues (2007, p. 215) note that "LGB students are also students who attend class, interact with faculty and peers, participate in cocurricular activities, live on campus, and are academically and socially influenced by their college environments."

According to social capital theory, **social networks** are relationships that convey useful resources that benefit some majority group members, while groups that are traditional outsiders—such as SGM individuals, especially if they are "out"—might have less access to these networks (Lin, 1999; Martin, Gipson, and Miller, 2011). Social networks offer multiple forms of support that relate to degrees and careers, subject knowledge, psychological and emotional support, and role modeling (Nora & Crisp, 2007). Primary sources of social networks for undergraduates generally include faculty mentoring, positive peer relationships, and local and national disciplinary organizations, relationships that are also key to the development of SGM students (Renn, 2007; Stewart & Howard-Hamilton, 2015). Nevertheless, SGM students may have difficulty finding faculty mentors who can also serve as role models (Dugan & Yurban, 2011; Tillapaugh, 2015) as it may be dependent on the number of "out" SGM faculty in their departments (Stewart & Hamilton, 2015). Additionally, not all transgender students receive the same level or quality of faculty mentoring (Dugan, Kusel, & Simounet, 2012).

Student peer relationships also affect student persistence and retention (Gershensonfeld, 2014). The amount of, and degree to which, a student has positive interpersonal interactions with peers can predict student success and intellectual as well as personal development (Halawah, 2006). Conversely, negative peer relationships, as the most likely source of harassment and exclusion experienced by SGM students, may impact their persistence (Pryor, 2015; Vaccaro, 2012). Outreach to local and national LGBTQ organizations (e.g. oSTEM) may be very important for SGM undergraduates, who frequently report the need to establish relationships with faculty, staff, and peers outside their discipline (Vaccaro, 2012) as such organizations may create a physical or epistemological safe space outside their academic departments (Museus & Jayakumar, 2012).

Research Design

Our exploratory project will use a **mixed-methods** approach to gather crucial interview data from SGM STEM undergraduates and develop survey questions that we will test on a purposive sample of SGM STEM undergraduates, with the goal of creating a reliable and validated survey.

Project Timeline. In **Year 1**, we will initiate survey development by conducting in-depth interviews with SGM STEM undergraduates. We first develop an interview protocol and pilot test it with 6 SGM STEM undergraduates at UConn and USF ($n = 3$ at each university). After refining the protocol, we will conduct 40-minute video-recorded interviews using Skype with 30 SGM STEM undergraduates. Interviewees will be recruited from the participating national professional associations (see letters of collaboration); American Chemical Society (ACS); American Physical Society (APS); National Organization of Gay and Lesbian Scientists and Technical Professionals, Inc. (NOGLSTP); Out in Science, Technology, Engineering, and Mathematics (oSTEM); OUT for Undergrad (O4U); and the Society for Women Engineers (SWE).

In **Year 2**, we will use the interview findings, our prior research, and relevant literature to develop a preliminary survey. To identify structural and/or cognitive issues with the preliminary survey and to further assess face and content validity, we will conduct a *Think Aloud* exercise with 6 SGM STEM undergraduates at UConn and USF ($n = 3$ at each university). The Think Aloud exercise is a cognitive evaluation method from psychology widely used in education research (Karabenick et al., 2007; Trenor, Miller, & Gipson, 2011). Participants will read the questions out loud as they take the survey on a laptop in the researcher's office. They will be informed that they are evaluating the survey and asked to be forthright with the researcher if any questions are unclear. We will then pilot test the revised survey with 30 SGM STEM undergraduates to determine validity and to further refine the survey.

The final survey instrument will then be administered using the Qualtrics platform to SGM STEM undergraduates recruited through the participating national professional associations noted above. We will employ **ego network analysis**, **multilevel logistic regression (MLR)**, and **intersectional analysis** using SAS 9.4 to analyze the results.

Research Questions. Table 1 presents our three research questions. RQ1 and RQ2 assess the relationships between our two independent variables and persistence, while RQ3 assesses the relationship of STEM academic climate and social networks on the persistence of SGM undergraduates.

Table 1. Exploratory Research Questions and Analyses

Research Questions (RQ)	Analyses
RQ1. How do students perceive their STEM academic climate in relation to their persistence?	Multilevel Logistic Regression (MLR) + Thematic Analysis
RQ2. What are their social networks and how do their social networks contribute to their persistence?	Ego Network Analysis + MLR + Thematic Analysis
RQ3. How do students' perceptions of STEM academic climate and their social networks contribute to their persistence in STEM?	MLR+ Intersectional Analyses

Semi-Structured Interviews. The interviews will provide rich data that is critical to our understanding of participants' experiences of STEM academic climate, social networks, and persistence in STEM programs—issues not fully addressed in other qualitative projects with SGM STEM students, particularly not across multiple STEM disciplines. We will also use the interviews to help us reconceptualize persistence as strategic choice by asking participants about their approaches to their STEM degrees (including switching majors or programs). Do, and how do, SGM STEM students find an epistemological safe space in the pursuit of their degrees? (Museus & Jayakumar, 2012). Together, these data will inform survey item development and facilitate our selection of key open-ended questions to complement the survey's quantitative measures. To design the interview protocol, we will use our previous

research and extant literature. The interviews will include open-ended questions that encourage participants to give expansive and descriptive answers (LeCompte & Preissle, 2003; Spradley, 1979). For example: How has your STEM program demonstrated inclusiveness toward LGBTQ+ students? What relationships have you relied on for support as you pursued your STEM degree? What are the most important choices you have made to pursue your STEM goals? To encourage detailed responses, interview questions will include probes, like “tell-me-more” (Bernard, 2011).

Survey. Based on our initial review of existing validated instruments on campus climate (e.g. Rankin et al., 2010; Woodford & Kulick, 2015) and our previous instruments (Borman et al., 2010; Chanderbhan-Forde et al., 2012; Smith et al., 2015; Tyson et al., 2010; Wao et al., 2010; Wao & Lee, 2010), we have identified potential items (see Table 2) for inclusion in preliminary versions of the online survey. These will be revised and complemented by questions developed from the interview findings. All participants will be asked to indicate, by using a 5-point Likert-type scale (1= Strongly Disagree --- 5= Strongly Agree), the extent of their agreement with each item.

Table 2. Examples of Questions on SGM Undergraduate Survey

Construct/Element	Sample Items (1 = Strongly Agree – 5 = Strongly Agree)
Faculty mentoring/advising relationships	I feel comfortable speaking to at least one faculty member about my sexuality and/or gender identity.
Peer relationships	I am comfortable talking with my STEM peers about my sexuality and/or gender identity.
Organizational memberships	I have created supportive relationships with others in my field through my membership in a national society.
STEM academic climate	My teachers use my correct name and gender pronouns.
Dichotomized outcome variables	I intend to stay enrolled and complete my STEM degree. I intend to switch to another program → Please explain. I have previously switched to another program → Please explain.

Data Collection Process. All participants in the pilot interviews and Think Aloud protocol will be recruited from our two participating universities (UConn and USF) using broad email solicitations of SGM and STEM undergraduate organizations and snowball sampling. All final interview participants will be recruited from our six partner organizations. The PIs will work closely with our Advisory Board and our partner organizations to ensure we use efficient and confidential ways to recruit SGM undergraduates to participate in interviews and to email participants the final survey link. Pilot survey participants will be recruited from the interview participants and SGM STEM undergraduates at UConn and USF.

To incentivize participation, each SGM STEM undergraduate who participates in the pilot or final interviews will receive a \$25 incentive. Each SGM STEM undergraduate will receive a \$20 incentive for participating in the Think Aloud exercise or the pilot test of the survey. All final survey participants will be entered into a drawing for one of five \$100 electronic gift cards. To protect identities, participants will be directed to a separate form to provide their contact information to keep their survey responses anonymous.

Final Survey Sample. For the reliability-test of the final survey version, the sample will be a purposive sample of SGM undergraduates majoring in STEM degrees recruited from our six partner organizations. Based on our experiences on previous NSF-funded survey research, we anticipate a sample size of 487, a 25% response rate from each organization (Table 3). As part of inclusion criteria in the study, undergraduates will be asked to self-identify as SGM.

Recruiting a sample of SGM undergraduates across STEM disciplines has challenges. As estimates of the percentage of US adults who identify as LGBT range from 1.7% in North Dakota to 10% in the District of Columbia (Gates and Newport, 2013), there is the need for purposive sampling and snowball sampling to achieve a reasonable sample size. And, since our goal is to

recruit across STEM disciplines for this exploratory study, we partner with existing STEM-based SGM national organizations (oSTEM, O4U and NOGLSTP) and discipline-specific societies with dedicated SGM subdivisions (SWE, APS and ACS). SGM undergraduates may not be “out” or even be aware of SGM organizations. By distributing the survey to both types of professional organizations, we increase the opportunity to access SGM STEM undergraduates, regardless of their engagement with SGM networks.

Data Analysis

Qualitative Analyses. Our semi-structured interviews will be audio-recorded and transcribed, coded in QSR

NVivo 11.0, and **thematically analyzed** (Braun & Clarke, 2006; LeCompte & Schensul, 1999). Our coding will be theoretical (social capital theory), structural-driven (research questions) and data-driven (emerge from responses; Ryan & Bernard, 2003). To assess the level of agreement, two team members will each independently code two randomly selected transcripts. Our goal is to attain inter-coder reliability of Cohen's kappa = .80 before we start coding the remaining interviews (Bernard, 2011). To analyze the *Think Aloud* data, we will **categorize** participants' responses by structural issues (grammatical and formatting errors) and cognitive concerns (uncertainty about question meaning). The latter is most significant as they would be more likely to cause survey response error (Karabenick, et al., 2007; Trenor et al., 2011). We will review participants' feedback and then draw on our team's expertise to collaboratively revise these items.

Quantitative Analyses. Based on results of the pilot testing, we will revise the survey items to enhance content validity of the survey instrument. Cronbach's alpha (α) (Cronbach, 1951) will be used to test internal consistency of the instrument using data from our reliability test. That is, we will assess how well the items measuring STEM academic climate and social networks fit together conceptually (Nunnally & Bernstein, 1994). Based on the number of items in the survey, we will interpret $\alpha = .70$ as indicative of acceptable reliability (Cortina, 1993; DeVon et al., 2007).

For the final survey, building on Van der Gaag and Snijders' (2005) *resource generator* measure of social capital and Martin et al.'s (2011) *resource and name generator* measures contextualized in engineering, we will use **ego-network analysis** (ENA) to examine the relationship between students' social networks and persistence. We will treat each ego-alter network as its own world (i.e., alters of two students need not interact), with measures of interest including *network size* (number of alters in ego's network) (Borgatti, Jones, & Everett, 1998; Lin, 1999, 2001) and *strength of ties* (e.g., frequency of ego-alter communication) (Borgatti et al., 1998; Granovetter, 1973).

To assess how social networks and STEM academic climate are each associated with persistence (outcome), we will employ **multilevel logistic regression** (MLR). Because SGM undergraduates (level-1 unit of analysis) are nested within programs (level-2 unit of analysis), MLR allows us to model the hierarchical nature of data (Raudenbush & Bryk, 2002). Specifically, we will examine the log odds of persisting in the program (e.g., coded 1 if persisted vs. 0 if switched out) as a function of STEM academic climate measures (**RQ1**) and social network measures (**RQ2**) as well as interaction terms as part of our **intersectional analysis** (e.g., sexuality x race/ethnicity [within-level]; sexuality x program [across-level], etc.). As noted by Scott and Siltanen (2017), multilevel modeling including context [program] as a higher-order level of analysis “offers a conceptualization of intersectionality that is most consistent with the feminist literature” (p. 373). It explicitly accounts for the social context of inequality by using context itself

Table 3. STEM-Related Organization by Undergraduate Membership

National Professional Society	Undergraduate Members	Estimated SGM
SWE	17000	850 [‡]
APS	6000	300 [‡]
ACS	1800	90 [‡]
oSTEM	400	400*
O4U	210	210*
NOGLSTP	100	100*
Total	25510	1950

[‡] Based on Gates & Newport's (2013) figures, we have used 5% as the median estimate for our sample.

* Membership is primarily LGBT individuals

as a unit of analysis and source of variance. To explore the combined impact of STEM academic climate ($C_{i's}$) and social networks ($S_{i's}$) on persistence (Y) (**RQ3**), the two sets of explanatory variables ($C_{i's}$ and $S_{i's}$) will be included in the model. Because we are only studying SGM STEM students, applying an intersectional lens to the analysis allows us to tease out differences among participants, thereby not considering SGM STEM students as a “category” of similarly situated students (see e.g. Rouhani, 2014). Cognizant of possible sample size issues with this approach, as suggested by Rouhani (2014), we will consider oversampling participants, using more encapsulating social identity groupings rather than programs, and increasing alpha to $p < .10$ level.

Key Personnel and Responsibilities

This research is a collaboration of a multi-institutional interdisciplinary team. Each member of the collaboration will contribute to all aspects of the projects, including development of the survey and authorship of peer-reviewed publications. In addition, UConn PI **Smith**, will lead the project in all phases and aspects. She will supervise the research team through bi-monthly project meetings and administer the grant on a daily basis, including authoring the annual reports and manuscripts. USF PI **Hughes Miller** and co-PI **Mayberry** will work with **Smith** to conduct and analyze the interviews. Consultant **Wao** will lead the quantitative component of the project. UConn **Dr. Campbell**, Research Assistant, will assist with the development of the interview protocols, conducting interviews, the Think Aloud exercise, survey development and distribution, data management, and contribute to our dissemination efforts.

To guide our research on this understudied population, we have formed an **Advisory Committee** comprised of Barbara Belmont, M.S., California State University – Dominguez Hills, Dr. Daniel Cruz-Ramírez de Arellano, Chemistry, University of South Florida, and Dr. Eric Partridge, President, oSTEM. Each has extensive contacts in the SGM STEM community and will liaise with STEM professional organizations/societies to guide us in the most effective strategies to recruit SGM undergraduates and assure their confidentiality. We will also consult with them about the interview protocol and survey development process throughout the project. Our **External Experts Committee** includes Dr. John Skvoretz, Sociology, University of South Florida, a nationally recognized expert in social network analysis, Dr. Julie P. Martin, Sociology, Clemson University, expert in social capital in STEM and qualitative research, and Dr. Ellen Puccia, Beta Research Associates, Inc., an experienced evaluator with expertise in qualitative research. They will serve as informal external evaluators of our methodology and analyses each academic year.

Broader Impacts. Our collaborative, interdisciplinary theory-driven research impacts 1) STEM educators and policymakers by providing preliminary data about the persistence of SGM STEM undergraduates, as related to their experiences of STEM academic climate and social networks. Such data can be used to inform interventions to enhance SGM undergraduates’ success in STEM; 2) the six STEM national professional organizations participating in our study, by strengthening their efforts to raise awareness about issues affecting SGM individuals among their professional/faculty/student membership (~70,000 total) through our collaboration with their leadership; and 3) a broader academic audience by **disseminating our findings** to STEM education researchers, practitioners, policy makers, and the general public by:

- Presenting our findings at annual professional conferences such as the American Society of Engineering Education, the American Anthropological Association, as well as the annual conferences of STEM-specific disciplines (e.g., American Chemical Society).
- Submitting findings for publication in peer-review journals such as the *Journal of Educational and Behavioral Statistics*, *Journal of Higher Education*, *Journal of Homosexuality*, and *Anthropology and Education Quarterly*.
- Partnering with the Society of Women Engineers (SWE) to disseminate our findings to its 35,000 members electronically and promote our findings at its annual meetings.

NSF Prior Support

UConn PI **Smith** is currently the Co-PI/Program Manager/Qualitative Lead on the NSF-funded grant, *The Effects of Social Capital and Cultural Models on the Retention and Degree Attainment of Women and Minority Engineering Undergraduates* (#1432297, \$1,140,983.00, 2014-2018, PI Kersaint).

Intellectual Merit: Our findings so far indicate that parents/guardians, followed by teachers, have the most influence on students' decisions to pursue engineering in high school, while engineering peers, followed by advisors and engineering professor/faculty advisor had the most influence on students' decisions about how to succeed in the first year of their engineering undergraduate programs. Black males were less likely to believe in their ability to persist and succeed than White and Middle Eastern students and Asian males. Also, women were more likely to report experiencing biases, prejudices, and stereotypes related to their gender in their engineering programs.

Broader Impacts: Our findings have been presented in reports to the 10 participating Colleges of Engineering which impacts ~6400 women, ~2800 minority women, and ~9200 minority men enrolled in their programs. We have discussed our findings and potential collaborative publications with liaisons at these universities. Our findings will also impact STEM educators and policymakers by providing valid results about social capital and CMES that can be used to transform engineering culture and improve interventions to broaden the participation of women and minorities.

Publications: Designing a Survey for Engineering Undergraduates using Free Listing - An Anthropological Structured Technique. Proceedings of the 122nd American Society for Engineering Education Annual Conference and Exposition, Seattle, WA. Manuscripts are currently being prepared for publication in peer-review journals.

USF PI **Hughes Miller** is currently the Co-PI of the NSF-funded grant, *Broadening Participation of STEM Faculty through Work Design* (#1461617, \$380,000, 2015-2018, PI Allen).

Intellectual Merit: This interdisciplinary, multi-method grant examines the gendered patterns of work design among STEM faculty and assesses the viability of work design theory as an approach to understanding female STEM faculty experiences.

Broader Impacts: The research unites diverse expertise across several fields of science to apply a multidisciplinary perspective to the research questions. Funding supports doctoral student researchers who have gained research project management experience and have led the development of research products. The project also provides research experiences for undergraduates which contributes to the development of a scientifically literate workforce in that undergraduates who participate in research have reported cognitive gains such as increased confidence in their ability to do science and learning to think and work like a scientist. Developmental activities and experiences will include lab meeting and departmental presentations, scholarly article discussions, and written developmental plans.

Publications/Presentations: Initial findings were presented at the 2017 annual meetings of the Society for Industrial and Organizational Psychology and are being prepared for publication in peer-review journals.

USF Co-PI **Mayberry** was the evaluation Co-PI on the NSF-funded grant, *Chemistry Education Research Doctoral Fellows Program* (30733642, PI Bretz, 2008-2013).

Intellectual Merit: The chemistry education research (CER) Doctoral Fellows Program at Miami University is providing a targeted response to the critical need for scholars with deep content knowledge in chemistry and the specialized training to conduct CER.

Broader Impacts: Program evaluation findings suggest that the program has had a national impact on CER graduate students who are positioning themselves to become the new generation of CER scholars.

Publications. Multiple publications, including 22 journal articles, resulted from this award, but none with Mayberry as a co-author. A sample product is: Linenberger, K.J.; Bretz, S.L.. "A Novel Technology to Investigate Students' Understandings of Enzyme Representations," *Journal of College Science Teaching*, v.42, 2012, p. 45.

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CHRYSTAL A. S. SMITH
 Research Assistant Professor
 Department of Anthropology
 University of Connecticut
 354 Mansfield Road
 Storrs, Connecticut 06269
 chrystal.smith@uconn.edu

A. Professional Preparation

Howard University	Washington D.C.	Anthropology	BA 1991
University of Maryland	College Park	Applied Anthropology	MAA 1998
University of South Florida	Tampa, FL	Public Health/Epidemiology	MPH 2003
University of South Florida	Tampa, FL	Applied Anthropology	PHD 2009
University of South Florida	Tampa, FL	Anthropology	2010-2014

B. Appointments

2017-present	Courtesy Faculty, University of South Florida
2016-present	Assistant Professor in Residents, Anthropology, University of Connecticut
2014-2016	Research Assistant Professor, Anthropology, University of South Florida
2013-2014	Post-Doctoral Scholar, Sociology, University of South Florida
2010-2012	Post-Doctoral Scholar, Anthropology, University of South Florida
2005-2009	Graduate Research Assistant, Anthropology, University of South Florida
2001-2005	Graduate Research Assistant, Center for Urban Transportation Research, USF
1995-1996	Teaching Assistant, Anthropology, University of Maryland, College Park
1997	Research Assistant, University of Maryland School of Medicine, Baltimore

C. Products

(i) Related

Smith C. A. S. (forthcoming). Community Colleges as a Pathway for Low Income Women to Enter the Engineering Technology Workforce In S. N. Davis, S. Winslow, & D. J. Maume (Eds), *Gender in the 21st century: The stalled revolution and the road to equality*. University of California Press: California.

Smith, C. A. S., Wao, H., Martin, J. P., MacDonald, G. & Lee, R. (2015). Designing a Survey for Engineering Undergraduates using Free Listing – An Anthropological Structured Technique. *ASEE Annual Conference Proceedings*. Washington D.C.

Smith, C. A. S. (2014). Assessing Academic Women's Sense of Isolation in the STEM Disciplines. In P. J. Gilmer, B. Tansel, & M. Hughes Miller (Eds.), *Alliances for advancing academic women: Guidelines for collaboration in STEM fields* (pp. 97-113). Rotterdam: Sense Publishers.

Smith, C. A. S. & Thomas, S. (2014). Learning Through Collaboration: Lessons from AAFAWCE, a NSF ADVANCE-PAID Grant. In P. J. Gilmer, B. Tansel, & M. Hughes Miller (Eds.), *Alliances for advancing academic women: Guidelines for collaboration in STEM fields* (pp. 193-204). Rotterdam: Sense Publishers.

Tyson, W., Smith, C. A. S. & Nguema, A. N. (2010). To stay or to switch? Why students leave engineering programs. In K. M. Borman, W. Tyson, & R. H. Halperin (Eds.), *Becoming an engineer in public universities: pathways for women and minorities*. Pp. 53-80. New York: Palgrave Macmillian.

(ii) Significant

Wao, Hesborn O., Lee, Reginald S., Ochieng, Joel, Owuor Odondi, Georiadis, Akath Tenge, and Smith, Chrystal A. S. (2015). Predicting Degree Attainment in Engineering and Biological/Life Sciences: An Exploratory Study. *Journal of Women and Minorities in Science and Engineering* 21(4):347-362.

Smith, C. A. S. (2011). Living with sugar: Influence of cultural beliefs on type 2 diabetes self-management of English-speaking women. *Journal of Immigrant and Minority Health*, 14:640-647.

Estacion, A., Cotner, B. A., D'Souza, S., Smith, C. A.S., & Borman, K. M. (2011) *Who enrolls in dual enrollment and other acceleration programs in Florida high schools? (Issues & Answers Report, REL 2012-No. 119)*. Washington, DC: U.S. Department of Education, Institute of Education Sciences, National Center for Education Evaluation and Regional Assistance, Regional Educational Laboratory Southeast.

D. Synergistic Activities

- Dr. Smith is the Co-PI/Qualitative Lead/Project Manager of the National Science Foundation EHR Core Research grant (\$1,140,983, #1432297), *The Effects of Social Capital and Cultural Models on the Retention and Degree Attainment of Women and Minority Engineering Undergraduates* (2014-2018). The goal of this grant is to broaden the participation of women and minorities in engineering, groups that are traditionally underrepresented groups in STEM, by creating knowledge about the role that social capital and culture plays in their persistence.
- Dr. Smith is a qualitative researcher of the National Science Foundation ITEST grant (\$1,176,099, #1614707), *The IT College and CAREERS Readiness Project: Career Academy Research on Educational Experiences and Related Successes* (2016-19). This focuses on creating knowledge about how IT career academies contribute to the high school students' pathway into IT careers.
- Dr. Smith is a qualitative researcher of the National Science Foundation ATE grant (\$778,031, #1501999), *PathTech Life: Constructing a National Survey of Engineering Students through Regional and Statewide Testing* (2015-2018). This study focuses on development and refinement of a survey instrument that will be measure the experiences of students enrolled in engineering technology programs at community colleges.
- Dr. Smith was the project manager of the NSF ADVANCE-PAID collaborative grant (\$600,000, #0930164), *Alliance for the Advancement of Florida's Academic Women in Chemistry and Engineering* (2009-2013). This grant developed and implemented mentoring, recruitment, and leadership activities to advance the careers of STEM women faculty who are traditionally underrepresented groups in STEM. By conducting interviews with STEM women faculty, this grant also created knowledge about their feelings of isolation and experiences as minorities in their departments.

Michelle Hughes Miller

A. Professional Preparation		
Institution and Location	Field of Study	Degree and Year
Nebraska Wesleyan University	Sociology/Anthropology and Psychology	B.S., 1986
University of Nebraska-Lincoln	Sociology	M.A., 1990
University of Nebraska-Lincoln	Sociology	Ph.D., 1997

B. Appointments Held:

January 2014-present. Associate Professor, Department of Women's and Gender Studies, University of South Florida
August 2010-2013. Associate Professor, Departments of Sociology (51%) and Women's and Gender Studies (49%), University of South Florida
July 2007-2010. Director, University Women's Professional Advancement, Southern Illinois University, Carbondale, IL
August 2006- 2010. Associate Professor, Department of Sociology, Southern Illinois University, Carbondale, IL
August 2000- August 2006. Assistant Professor, Department of Sociology, Southern Illinois University, Carbondale, IL
January 1998- August 2000, Assistant Professor, Department of Criminal Justice, University of Nebraska at Omaha, Omaha, Nebraska
August 1996-December 1997, Instructor, Department of Criminal Justice, University of Nebraska at Omaha, Omaha, Nebraska

C. Products

1-Related

Gilmer, Penny, Berrin Tansel, and Michelle Hughes Miller, eds. 2014. *Alliances for Advancing Academic Women: Guidelines for Collaborating in Chemistry, Engineering, and Beyond.* Rotterdam, The Netherlands: Sense Publishers.

Martinez, Vanessa, Michelle Hughes Miller, and Will Tyson. 2014. "Analyzing STEM Faculty Demographics and Faculty Climate Survey." Pps 79-94 in *Alliances for Advancing Academic Women: Guidelines for Collaborating in Chemistry, Engineering, and Beyond*, edited by Gilmer, Tansel and Hughes Miller. Rotterdam, The Netherlands: Sense Publishers.

Beardsley, Rebeccca and Michelle Hughes Miller. 2002. "Revisioning the Process: A Case Study in Feminist Program Evaluation." *New Directions for Evaluation*, 96, Winter: 57-70.

2-Significant Publications

Kaukinen, Catherine, Michelle Hughes Miller and Ráchael Powers, editors. 2017. *Addressing and Preventing Violence Against Women on College Campuses.* Temple University Press.

Hughes Miller, Michelle, Tamar Hager and Rebecca Bromwich, editors. 2017. *Bad Mothers: Representations, Regulation and Resistance.* Demeter Press.

Hughes Miller, Michelle. Forthcoming, 2017. "Relying on Mothers: Motherwork and Maternal Thinking in Development Empowerment Discourse." Chapter in *Mothers, Mothering and*

Globalization, edited by Dorsía Smith Silva, Laila Malik, and Abigail Palko. Demeter Press.

- Hughes Miller, Michelle. 2015. "Mothering Outside-in: Confined Children and Mothering Under State Paternalism." Chapter in edited volume on *Criminalized Mothers, Criminalizing Motherhood*, edited by Joanne Minaker and Bryan Hogeveen. Toronto, ON: Demeter Press.
- Johnson, Melencia, Shelly McGrath and Michelle Hughes Miller. 2014. "Effective Advocacy in Rural Domains: Applying an Ecological Model to Understanding Advocates' Relationships." *Journal of Interpersonal Violence*, 29 (12, August): 2192-2217.

C. Synergistic Activities:

2016. USF PI on Collaborative grant: "*Academic Persistence in STEM: Effects of Social Networks and STEM Program Culture for Sexual and Gender Minority STEM Undergraduates*." (with the University of Connecticut as primary institution). NSF, \$421,967. Full grant is approximately \$880,000. Not funded; ranked "Highly Competitive."
2016. Co-PI on USF sub-contract on National Institute of Justice grant, "The University of Central Florida Violence Against Women Consortium." Submitted by PI Catherine Kaukinen. Under review.
2015. Co-PI on NSF grant, "*Effect of Program Culture and Social Networks on the Retention and Degree Attainment of Sexual and Gender Minority STEM Undergraduates*." Submitted by PI Chrystal S. Smith (USF at the time; University of Connecticut now). \$887,855. Not funded; ranked "Competitive."
2014. Co-PI on NSF grant, "SBP: Broadening Participation of STEM Faculty Through Work Design," submitted by PI Tammy Allen (USF). Funded at \$380,000.
2014. Co-PI and Assessment Manager on proposed NSF-ADVANCE PAID grant: "*Advancing Women-Faculty in Engineering (AWE)*," PI Grisselle Centeno (USF). Not funded.

Current and Pending Support

(See PAPPG Section II.C.2.h for guidance on information to include on this form.)

The following information should be provided for each investigator and other senior personnel. Failure to provide this information may delay consideration of this proposal.

Investigator: Michelle Miller	Other agencies (including NSF) to which this proposal has been/will be submitted.
<p>Support: <input checked="" type="checkbox"/> Current <input type="checkbox"/> Pending <input type="checkbox"/> Submission Planned in Near Future <input type="checkbox"/> *Transfer of Support</p> <p>Project/Proposal Title: SBP: Broadening Participation of STEM Faculty Through Work Design</p> <p>Source of Support: National Science Foundation</p> <p>Total Award Amount: \$ 380,000 Total Award Period Covered: 04/15/15 - 03/03/18</p> <p>Location of Project: University of South Florida</p> <p>Person-Months Per Year Committed to the Project. Cal:0.00 Acad:0.00 Sumr: 1.00</p>	
<p>Support: <input type="checkbox"/> Current <input checked="" type="checkbox"/> Pending <input type="checkbox"/> Submission Planned in Near Future <input type="checkbox"/> *Transfer of Support</p> <p>Project/Proposal Title: EAGER: Collaborative Research: Exploring the Effects of Academic Climate and Social Networks on the Persistence of Sexual and Gender Minority STEM Undergraduates</p> <p>Source of Support: National Science Foundation</p> <p>Total Award Amount: \$ 126,010 Total Award Period Covered: 09/01/17 - 08/31/19</p> <p>Location of Project: University of South Florida</p> <p>Person-Months Per Year Committed to the Project. Cal:0.00 Acad:0.00 Sumr: 1.00</p>	
<p>Support: <input type="checkbox"/> Current <input type="checkbox"/> Pending <input type="checkbox"/> Submission Planned in Near Future <input type="checkbox"/> *Transfer of Support</p> <p>Project/Proposal Title:</p> <p>Source of Support:</p> <p>Total Award Amount: \$ Total Award Period Covered:</p> <p>Location of Project:</p> <p>Person-Months Per Year Committed to the Project. Cal: Acad: Sumr:</p>	
<p>Support: <input type="checkbox"/> Current <input type="checkbox"/> Pending <input type="checkbox"/> Submission Planned in Near Future <input type="checkbox"/> *Transfer of Support</p> <p>Project/Proposal Title:</p> <p>Source of Support:</p> <p>Total Award Amount: \$ Total Award Period Covered:</p> <p>Location of Project:</p> <p>Person-Months Per Year Committed to the Project. Cal: Acad: Sumr:</p>	
<p>Support: <input type="checkbox"/> Current <input type="checkbox"/> Pending <input type="checkbox"/> Submission Planned in Near Future <input type="checkbox"/> *Transfer of Support</p> <p>Project/Proposal Title:</p> <p>Source of Support:</p> <p>Total Award Amount: \$ Total Award Period Covered:</p> <p>Location of Project:</p> <p>Person-Months Per Year Committed to the Project. Cal: Acad: Summ:</p>	

*If this project has previously been funded by another agency, please list and furnish information for immediately preceding funding period.

Exploring the Effects of Academic Climate and Social Networks on the Persistence of Sexual and Gender Minority STEM Undergraduates

Facilities, Equipment & Other Resources

UNIVERSITY OF CONNECTICUT

Location and Office Space

The University of Connecticut (UConn) is the premier research institution among public universities in New England and is ranked in the top 20 public universities nationwide according to US News and World Report. The State of Connecticut has transformed the University of Connecticut system with an invested \$2.6 billion in capital projects.

The proposed research will be undertaken at the University of Connecticut (UConn) College of Liberal Arts and Sciences, Storrs, Connecticut. PI Smith's and Campbell's offices are currently located in the Charles B. Gentry building. They have ample office space with ergonomic chairs and related equipment and access to telephones to contact other members of the team.

Hardware

PI Smith has a personal desktop computer, two monitors, a printer and access to department copiers. Campbell has a personal computer and access to department copiers. Their computers are connected via hubs to local and wide area networks to allow full Internet connections and video-conference meetings.

Software

UConn has site licenses for all of the software needed for this project, with the exception of NVivo for Teams, which is included in our budget. All computers have software capabilities including word processing (Word), spreadsheets (Excel), graphics (PowerPoint), desktop publishing (Publisher), reference management (Refworks), statistical analysis software Statistical Analysis Software [SAS]. All computers are backed up daily, and access to accounts is password-protected. Both the UConn and the University of South Florida have licenses for Qualtrics, the online survey software platform. Qualtrics will be used to administer of the online survey is accessible to all members of the research team through their universities. The team will routinely use technologies such as Outlook calendars and document sharing tools such as SharePoint.

Technical support

UConn University Information Technology Services (UITS) will provide technical support, with a 24 hour help desk available for live calls and email requests. UConn IT provides computer/technical support for installation and repair maintenance of computer and other equipment.

Library facilities

PI Smith and Campbell have access to the UConn main campus library which is staffed with research services with ready access (computerized databases) to research, university, law, and public libraries. Library staff participate in the OCLC Interlibrary Loan network to access articles, books, and other materials from technical research, and government libraries across the US and globally. Additionally, the UConn library offers chat, text, face-to-face, and desk services almost every day to students and faculty. Members of the research team have utilized the library services effectively to carry out different research studies including NSF-funded studies.

Conference room and meeting facilities

PI Smith and Campbell have access to conference rooms in both Charles B. Gentry building and Charles Lewis Beach Hall which have teleconferencing equipment that can easily be moved to other locations as needed. There are large conference rooms available for the group to use, as needed, along with ample parking space to accommodate visitors. Most of the conference rooms have ceiling-mounted projectors; retractable screens; flat panel monitors; and technology for Web conferencing. The conference rooms also have the equipment to facilitate video-communications, and the group uses Illuminate for Web conferencing or freely available Skype for communication.

Network, Information Technology infrastructure, and telecommunication facilities

UIT's corporate technology and telecommunications infrastructure supports access to local and wide area networks (LAN and WAN) and daily back up services. UITS owns and maintains the University's telecommunications cabling infrastructure and performs all installations for new construction, renovations, or any type of request for telephone, cable TV, network cabling and jacks. As the owners of the telecommunications infrastructure, UITS responds to Call Before You Dig requests and complies with codes and policies as directed by the University's Office of Fire Marshal and Building Inspector, and Environmental Health and Safety Office. UITS complies with codes and policies as directed by the University's Office of Fire Marshal and Building Inspector and the Environmental Health and Safety Office.

Administrative support

The UConn College of Liberal Arts and Sciences provides PI Smith with administrative and financial specialists to assist in grant administration. The UConn Sponsored Research office provides additional fiscal administrative and budgetary support. In conclusion, UConn has all the required expertise and logistics in place to successfully address the aims and objectives of the proposed study.

EAGER: Collaborative Research: Exploring the Effects of Academic Climate and Social Networks on the Persistence of Sexual and Gender Minority STEM Undergraduates

Facilities, Equipment & Other Resources

Location and Office Space

The proposed research will be undertaken at the University of South Florida (USF) College of Arts and Sciences, Tampa, Florida, where PI Hughes Miller and co-PI Mayberry's private offices are currently located in the Center for Multidisciplinary Studies building and Cooper Hall, respectively. All personnel have ample office spaces in their respective locations at USF. The offices are stocked with ergonomic chairs and related equipment, and all have access to phones to contact other members of the team.

Hardware

All members of the research team are equipped with a personal desktop computer or laptop computer with docking station and monitors. The computers are connected via hubs to local and wide area networks to allow full Internet connections. The network is 10 GIG category 6 cabling, running through a 33 gigabyte state-of-the-art Cisco backplane. Edge devices are linked to this redundant dual-homed network (Level 3 and Version) at no less than 1 gigabyte bandwidth. No device on the network is ever less than 100 megabytes. The communications systems at USF include Microsoft 365 running on a robust Active Directory network.

Software

USF has site licenses for much of the software needed for this project, with the exception of NVivo, which we have included in our budget. The computers have software capabilities including word processing (Word), spreadsheets (Excel), graphics (PowerPoint), desktop publishing (Publisher), reference management (Endnote), statistical analysis software (Statistical Analysis Software [SAS], pre-installed statistical packages (including Statistical Package for the Social Sciences [SPSS], SYSTAT, R-project, Winbugs and Stata), web design (Coldfusion, ASP.NET), database management packages (MS Access, and Oracle), and qualitative software (ATLAS.ti 6.2). Software used via free downloads include G*Power, LaTeX document preparation system. All computers are backed up daily, and access to accounts is password-protected. The research team has access to a copy of Meta-analysis Review Manager 5.0, which is recommended by the Cochrane Collaboration for conducting systematic reviews and meta-analysis. It is worth noting that Qualtrics, the data management software that will be used for administration of the online survey, is freely accessible by all members of the research team. The team routinely uses technologies such as Outlook calendars and document sharing tools such as SharePoint.

Technical support

USF Information Technology (IT) will provide technical support, with a 24 hour help desk available for live calls and email requests. USF IT provides computer/technical support for installation and repair maintenance of computer and other equipment. Based on our experience in previous NSF-funded research, we have not experienced any issues that the IT team could not resolve in a matter of minutes.

Library facilities

All members of the research team have access to the USF main campus library which is staffed with research services with ready access (800 computerized databases) to research, university, law, and public libraries. Library staff participate in the OCLC Interlibrary Loan network to access articles, books, and other materials from technical research, and government libraries

across the US and globally. Additionally, the USF Tampa library offers chat, text, face-to-face, and desk services almost everyday to students and faculty. Members of the research team have utilized the library services effectively to carry out different research studies including NSF-funded studies.

Conference room and meeting facilities

All personnel have access to conference rooms in their respective locations which have teleconferencing equipment that can easily be moved to other locations as needed. There are large conference rooms available for the group to use, as needed, along with ample parking space to accommodate visitors. Most of the conference rooms have ceiling-mounted projectors; retractable screens; flat panel monitors; and technology for Web conferencing.

Each team member's computer has a camera for video-communications, and the group uses Illuminate for Web conferencing or freely available Skype for communication. In the past NSF-funded projects, our team has used these facilities to conduct meetings without any problems.

Network, Information Technology infrastructure, and telecommunication facilities

USF's corporate technology and telecommunications infrastructure supports access to local and wide area networks (LAN and WAN) and daily back up services. LAN and WAN supports more than 3,750 staff distributed across more than 70 offices in addition to client sites and other home-based offices. There is VoIP with call forwarding, conference call feature, speakerphone and voicemail, teleconferencing up to 125 participants per call controlled access via passcode security. USF also has state-of-the-art Tier IV data Center available for secure and reliable hosting using the latest in firewall and security monitoring technology. There are triple redundant megawatt (MW) back up power generators and network connectivity is assured through the use of multiple and diverse Tier I Internet providers.

Administrative support

The USF College of Arts and Sciences provides PI Hughes Miller with administrative and financial specialists to assist in grant administration. The USF Sponsored Research office provides additional fiscal administrative and budgetary support.

In conclusion, USF has all the required expertise and logistics in place to successfully address the aims and objectives of the proposed study.

Data Management Plan (DMP)

1. Data and materials

This study, conducted collaboratively by the University of Connecticut (UConn) and University of South Florida (USF), will produce quantitative (surveys) and qualitative (semi-structured interviews) instruments and data. In year 1, we will conduct semi-structured interviews. In year 2, an online survey will be administered to SGM undergraduates majoring in STEM.

2. Standards to be used for data

Survey data will be collected using Qualtrics, an online survey platform available through UConn. These data will be downloaded to UConn's secure password-protected computer servers. After the data is de-identified and entered in Microsoft Excel, it will be shared securely with the USF team and Consultant who will store these data on USF's secure password-protected computer servers. Consultant Wao will be appointed as an UConn affiliate so he will have access to both UConn and USF secured password-protected computer servers. He will perform ego network analysis and multilevel logistic regression to analyze the quantitative data. Data will be categorized by type, participant identifiers, sexuality/gender identity, and ethnicity. SAS 9.4 will be used to analyze the survey data.

All participants will be assigned an identifier. The qualitative interviews will be conducted by UConn PI Smith, UConn Other Personnel Campbell, USF PI Hughes Miller, and USF co-PI Mayberry using Skype or another online video communication program. Interviews will be digitally audio-recorded and the files stored on both UConn and USF secured password-protected computer servers. PI Smith has a courtesy faculty appointment at USF and has access to both UConn and USF secured password-protected computer servers. The assigned identifiers will be used to name the recording files and then securely sent to the transcriptionist where they will be transcribed into Microsoft Word files. Thematic analysis of the qualitative data will be performed in NVivo, a qualitative data analysis software program.

As the lead university, UConn will store all transcripts on its secured password-protected computer servers. UConn has a NVivo 11 license. USF will use grant funds to purchase a NVivo 11 license. UConn will use grant funds to purchase NVivo for Teams which will allow the created project to be hosted on a secure NVivo server. This will allow UConn and USF team members to share data and collaborate in real time. We will be able to work on the same project at the same time and view each other's updates.

3. Policies for access and sharing data

All information and documents (i.e., informed consent forms, surveys, interview recordings) completed by participants will be used for research purposes only and will be kept in strict confidence. Any contact information that participants voluntarily provide will only be used with their permission to compensate them with incentives or to conduct research activities such as participating in the interviews or responding to the survey. Confidentiality will be maintained by assigning participants' numerical identifiers. Documents linking these identifiers to their contact information will be stored on UConn's secured password-protected computer servers.

Participants will be informed that their responses will not be used for any other purposes than conducting statistical analyses and obtaining results for eventual publication. This information will be stored on UConn's secured password-protected computer servers. For qualitative data, pseudonyms will be used in all transcribed materials. There will be no identifying information associated with any data after it is collected. All data will be recorded under the identification

number and/or pseudonym. Data will be de-identified and aggregated as necessary to ensure anonymity of participants.

To facilitate coordination of all data collection, all physical materials will be secured off-site (e.g., locked cabinets and locked offices) in UConn PI Smith's office at the University of Connecticut as Project Manager and PI. She will maintain these documents for the project. Informed consent documents, participants' contact information, and other identifying documents will be stored separately from the data in a locked filing cabinet and will only be available to the research staff involved in this project.

UConn and USF servers on which the research will be saved are part of computer networks that are backed up daily by information technology staff. The servers are protected by firewall technology to prevent unauthorized access or tampering. Up-to-date virus protection software protects each computer and server. Identifying information will not be reported in the dissemination of research results.

All research team members have received training in human subject issues required of all investigators at their respective universities' Institutional Research Boards (IRB). Their Collaborative Institutional Training Initiative (CITI) certificates are current. As part of the regular ethical research review protocol, all research instruments and activities along with the external evaluation will be submitted and approved by the UConn IRB. USF IRB will sign an IRB Authorization Agreement agreeing to rely on UConn's IRB approval.

4. Policies and provisions for re-distribution and production of derivatives

As requested, we will collaborate with representatives of participating universities to analyze datasets and produce publications. This study will produce the following:

- Annual written reports to NSF.
- Presentations of our findings and methodologies at annual professional conferences such as the American Society of Engineering Education, the American Anthropological Association, the American Sociological Association as well as the annual conferences of STEM-specific disciplines (e.g., American Chemical Society).
- Publications in peer-review journals such as the *Journal of Educational and Behavioral Statistics*, *Journal of STEM Education*, *Project Muse*, *Journal of Homosexuality*, *Journal of College Student Development*, *Journal of Research on Science Teaching*, and *Anthropology and Education Quarterly*.
- Partnership with the Society of Women Engineers (SWE) to disseminate our findings to its 35,000 members electronically and promote our findings at its annual meetings
- Publications in STEM practitioner sources and on Web sites.

5. Plans for Archiving Data

According to UConn IRB policy as per federal regulations (45 CFR 46.115(b) and 21 CFR 56.115(b)), "investigators must maintain research records for three years beyond the completion/termination of the study." At the conclusion of the project, hard copies of all project documents will continue to be stored off-site (e.g., locked cabinets and locked offices) in PI Smith's office at the University of Connecticut. All PIs and co-PIs will have access to these files. All study documents such as scholarly articles, white papers, and presented papers will be uploaded to the assigned UConn server so they will be available to other STEM researchers, the national and local media, and the general public.