



LSAMP-NICE: Expanding International STEM Research for Underrepresented Minorities

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Background: The global challenges of climate change, disease and hunger exceed national borders as do possibilities of sustained life, exploration and economic development in outer space. Both help to underscore the need for sustained international STEM research to leverage the talent embedded in different countries and in diverse groups within countries. This study focuses on the United States National Science Foundation provision of funds to its Louis Stokes Alliance for Minority Participation (LSAMP) Program to create a National Center of Excellence LSAMP-NICE for the establishment of international STEM Research Partnerships with a particular emphasis on the integration of international collaborative research for underrepresented minority STEM faculty, students and graduates. The study focuses on the diffusion of this Center's services to the LSAMP Community, a group of 56 LSAMP funded STEM enrichment programs located across the United States. We found that LSAMP-NICE used mass media (a website and two advertorials in a national journal) and an annual national meeting as its major diffusion strategies during its first two years. Forty-two (42) programs responded to the questionnaire. The majority of the respondents (71.4%) had not used the website; 88.1% had not read the Advertorial in Science Magazine; and 78.6% did not attend the national 2019 LSAMP-NICE Annual Meeting in Washington, D.C. Our study suggests a need for additional diffusion techniques to reach the intended audience. Some respondent suggestions for diffusion include participation by LSAMP-NICE representatives at LSAMP Regional Conferences and Symposia, visits by LSAMP-NICE staff to LSAMP programs, forging relationships with higher education institutions abroad so LSAMP students can obtain summer or longer-term research experiences and providing technical assistance on applying for international travel funds.

Keywords: diversity, international, partnership, diffusion, STEM, alliances, research, innovations

INTRODUCTION

The National Science Foundation (NSF) has funded the Louis Stokes Alliance for Minority Participation (LSAMP) International Center of Excellence since 2018¹ to help ensure a well-prepared cadre of underrepresented STEM scientists representing America's contribution to the global society's knowledge base in addressing the health, safety, security and environmental well-

¹National Science Foundation, September 1, 2018, NSF Proposal Number 1826824, HRD—Alliances-Minority Participation.

being of humanity. For 30 years of funding, LSAMP has built a nationwide group of Alliances focused on broadening STEM participation of underrepresented minorities at college and university campuses including Historically Black Colleges and Universities, Tribal Colleges, Traditionally White Institutions and institutions serving other minority populations including Native Pacific Islanders and Alaskans. During the period of data gathering, there were fifty-six Alliances² which are referred to in this study and in the STEM professional community as “The LSAMP Community.” In 2018, in response to the recommendation of the Project Director, Dr A. James Hicks and a review panel, the National Science Foundation funded the Louis Stokes Alliance for Minority Participation NSF International Center of Excellence. The goal of the Center is to help increase the number of STEM international research partnerships for United States underrepresented minority faculty, students and post-doctoral alumni. This exploratory study was designed to describe the diffusion strategies used by LSAMP-NICE and the use and adoption of the Louis Stokes Alliance for Minority Participation NSF International Center of Excellence enhancement strategies by the LSAMP Community. The study is grounded in Everett Roger’s theory of the diffusion of innovations³ which explains how and why innovations or new strategies are or not embraced. LSAMP-NICE is conceptualized as an innovation supported by NSF LSAMP to serve as a connecting and facilitating link between United States colleges and universities, especially those with LSAMP-funded programs, and international universities and laboratories with strong STEM research portfolios and an interest in international research partnerships. LSAMP-NICE is also tasked to serve as point of contact in the United States for international colleges, universities and laboratories who are interested in partnering with United States researchers and institutions. The focus of this study is on LSAMP-NICE as a resource to the LSAMP Community in facilitating and increasing the number of active international research partnerships which can result in an increase in the number of United States underrepresented minority STEM faculty, students, and post-doctoral graduates who enhance their STEM knowledge, research skill and appreciation for the value of global STEM research.

Theoretical Framework

This study is grounded in innovation and diffusion theory. Everett Rogers is a pioneer in the United States in the development and advancement of this theory (Rogers, 2003). He first used this theory to study acceptance of hybrid corn by Iowa farmers and later to study areas such as health care promotion. Today this theory is being used in marketing and commercialization. Rogers outlines key characteristics of the new or innovative concept that impact the targeted groups’ acceptance of the innovation. These include relative advantage, compatibility, complexity, trial ability and observability of the innovation (Rogers, 2003). Implicit in this typology is the

potential adopter’s perception of the gains from adapting the new concept or practice, the fit of the innovation with the adopter’s existing practices and values, the potential gain such as improved standard of living or market expansion, the difficulty in implementing the new approach, the need to sample or “try out” the proposed product or concept and finally actually witnessing the adoption of the innovation and the outcome for others. Rosen focused on the impact of the personal communication process in diffusing innovations (Rosen, 2009)⁴. He emphasized the importance of ‘Word of Mouth’ communication in diffusing new concepts. Labeled ‘The Buzz,’ attention is focused on the importance not only of what is being said but also on who within the trusted groups is endorsing or rejecting the new concept. In “Theories of Innovation Adaptation and Real World Case Analyses,” Marcia Ham uses Everett Rogers’ theory of innovation as the basic theoretical framework. Her emphasis is on the adoption of technology in higher education. Her study offers a contemporary example of innovative ways that business and higher education can create and diffuse new opportunities for educational achievement by students who may be challenged by the cost of higher education, who take jobs to help pay for their education and who eventually drop out because of the competing time demands. Ham’s description of the Starbuck College Achievement Plan in collaboration with Arizona State University (ASU) offers an example of an innovative concept and its diffusion. The plan, as it emerged, added the Starbuck Pathways to Admissions with ASU (an innovation) for those students who were having difficulty meeting the university’s admission standards and diffused this opportunity to the Starbuck employees thus paving the way from them to enter and compete in more than seventy on-line degree programs. From the review of innovation models, Ham concluded that the commonality of variables most likely to influence the acceptance or rejection of the innovation are socio-political and external factors such as environment, policies, regulations, social networks organizational characteristics such as leadership, social climate and organizational structure; and innovation characteristics such as complexity, compatibility and trialability (Ham, 2018)⁵. In this study, the National Science Foundation Louis Stokes Alliance for Minority Participation (LSAMP- NICE) Center of Excellence is conceptualized as an innovation in the area of fostering an increase in the number of international research partnerships for NSF LSAMP funded undergraduate and graduate Science, Technology, Engineering and Mathematics (STEM) research training programs focused on underrepresented minorities and administered by 56 LSAMP Alliances located across the United States of America. This study is focused on the diffusion process used by the LSAMP-NICE Center of Excellence as an innovation and the adoption of the Center’s

⁴Rosen, Emanuel (2009). *The Anatomy of the Buzz Revisited*. Doubleday.

⁵Ham, M. (n.d.). Theories of innovation adoption and real-world case analyses. In Correia, A. (author), *Driving educational change: Innovations in action*. Pressbooks. <https://ohiostate.pressbooks.pub/drivechange/>

²https://www.nsf.gov/funding/pgm_summ.jsp?pims_id=13646

³Rogers, Everett (2003). *Diffusion and Innovations*. Fifth Edition. Free Press.

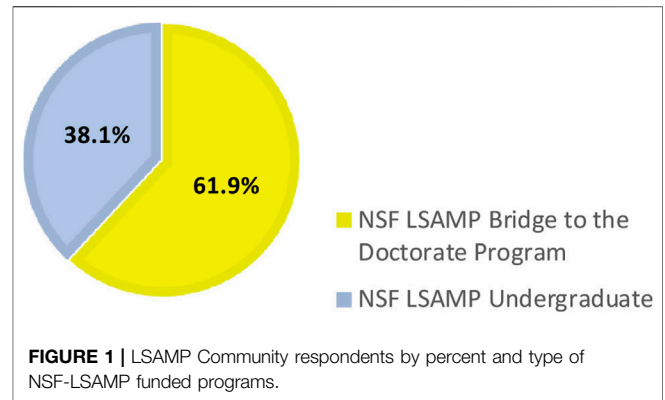
strategies by the LSAMP Community from 2018 to December 2020.

METHODOLOGY

A nine-item questionnaire was used for data collection. The LSAMP Alliances were identified by querying the NSF website at https://nsf.gov/awardsresearch/October_2019 for currently funded NSF-LSAMP Alliances. Also, the LSAMPCommunity@LISTSERV.NSF.Gov was used to further identify the LSAMP Community. Through this process, 56 LSAMP Alliances were identified and were emailed the nine-item survey. Forty-two (42) non-duplicative responses were received. The questionnaire (see **Supplementary Material**) included background information including name of the college or university, identification of P. I. or person completing the questionnaire, years of NSF LSAMP funding, type of program (Bridge to Doctorate and/or Baccalaureate), list of current international partnerships, knowledge of the LSAMP-NSF International Center of Excellence and LSAMP principal investigators' suggestions on ways that the Center can help their LSAMP Programs develop and formalize more international STEM research partnerships leading to expanded collaborative research.

The Sample

The LSAMP respondents reflect an experienced group of NSF-LSAMP funded program administrators. More than half (55%) of the sample of 42 reported from 16–30 years of experience in LSAMP program delivery. The sample also included professionals with developing experience in LSAMP program delivery. For example, nearly 12% of the sample ($N = 5$) had from 1 to 5 years of experience in LSAMP program delivery. This could reflect a newly funded program or a newly appointed P.I. **Supplementary Table S1** depicts the range of leadership by years of experience in NSF-LSAMP funded program delivery for the members of the LSAMP Community who participated in this study. (See **Supplementary Table S1**). In this study, the majority of the programs (61.9%) were funded for the NSF LSAMP Bridge to the Doctorate Programs. Bridge to Doctorate (BD Activity) are projects that focus on providing post-baccalaureate fellowship support to cohorts of 12 LSAMP students from underrepresented minority populations for successfully earning STEM doctoral degrees and transition into the STEM workforce. Only institutions in well-established alliances, funded for 10 or more consecutive years, are eligible for this funding opportunities. These are 2-year awards.⁶ The large percentage of LSAMP Bridge to the Doctorate programs in this sample (See **Figure 1**) is indicative of the wealth of experience amassed by NSF LSAMP funded program administrators while delivering undergraduate NSF LSAMP STEM enrichment programs and subsequently leveraging that experience to successfully develop a Bridge to the Doctorate proposal that was funded by NSF-LSAMP.



ANALYSIS OF DATA

The focus of this study was to examine LSAMP Community awareness and use of the Louis Stokes Alliance for Minority Participation NSF International Center of Excellence (LSAMP-NICE) to increase their number of international partnerships for STEM research. Data are presented on awareness and use, along with recommendations from the LSAMP Community on strategies that the Center could use to increase utilization of its services and thereby potentially increase the number of international research partnerships for the LSAMP Community.

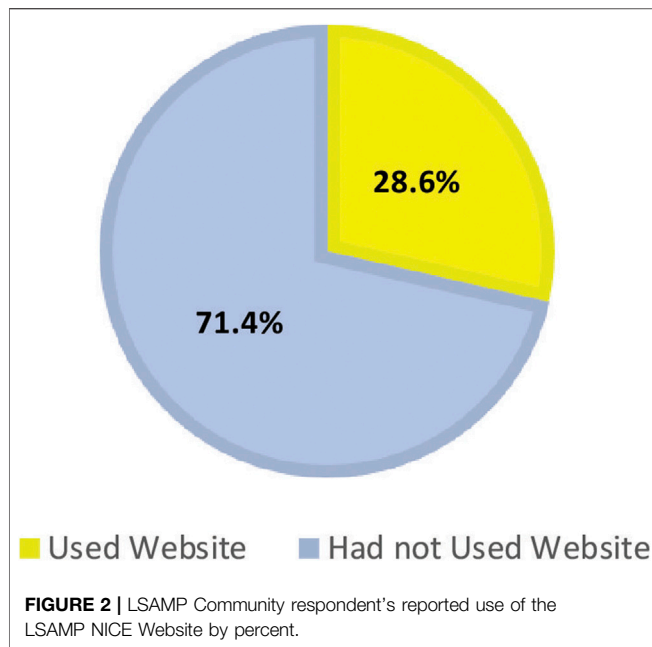
AWARENESS OF LSAMP-NICE

LSAMP-NICE, an NSF funded program established in 2018, is conceptualized as an innovative concept designed to help increase the number of international research partnerships with an emphasis on underrepresented minority faculty, scientists, students and post-doctoral alumni, who are products of NSF-LSAMP funded colleges and universities STEM enrichment programs. No other NSF National Center has this specific charge. Three major strategies were used by LSAMP-NICE to introduce this innovative concept to the LSAMP Community. Included were a website, an annual national meeting and two advertorials in SCIENCE Magazine. The respondents' use of these three introductory and information diffusion strategies are presented in **Figures 2, 3, and 4**.

The LSAMP-NICE Website (<http://lsamp-nice.org>) (See **Supplementary Material**) was designed as a repository of information for the LSAMP Community and the scientific community at large. There was to be a database of collaborative research opportunities and resources with links to international collaborative partners providing information and resources.⁶ At the time of this study in Fall 2020, the majority of the LSAMP Community respondents had not used the website. Just over one-fourth (28.6%) of the respondents had used the LSAMP-NICE Website compared to slightly over 70% (71.4%) who had not used the website (see **Figure 2**).

The partnership with Science Magazine was meant to expand the reach of information highlighting collaborative international research activities and successes in STEM as a result of LSAMP-NICE partner resources availability. The Science Advertorials

⁶https://www.nsf.gov/funding/pgm_summ.jsp?pims_id=13646

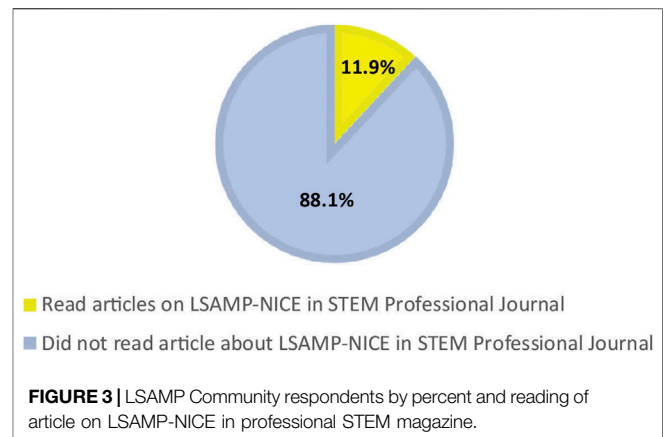


published in April 2020 and September of 2020 were paid publications presenting evidence of faculty and LSAMP student engagement in international collaborative research. SCIENCE Magazine online readership is highlighted in **Supplementary Material S2**. The majority (88.1%) of the LSAMP Community respondents had not read about LSAMP-NICE in the SCIENCE Magazine, the professional journal where the two LSAMP-NICE advertorials were published.

LSAMP-NICE International Center of Excellence First Annual Meeting was designed to introduce LSAMP-NICE to the LSAMP Community and to potential international STEM collaborative research partners and to simultaneously introduce the LSAMP Community to LSAMP-NICE. By poster exhibits, student and faculty STEM research underway at LSAMP Community colleges and universities was presented to inform LSAMP-NICE and the visiting international researchers and research administrators of current STEM research underway. The Annual Meeting was held in September 2019 at the Embassy of France in Washington, D.C. Sixty-five persons were in attendance including researchers and research administrators from France, Panama, Saudi Arabia, South Africa and Taiwan along with representatives from the National Science Foundation and some regional alliances. (See **Supplementary Materials S3**). The majority of the LSAMP Community respondents in this study (78.6%) were not in attendance (See **Figure 4**).

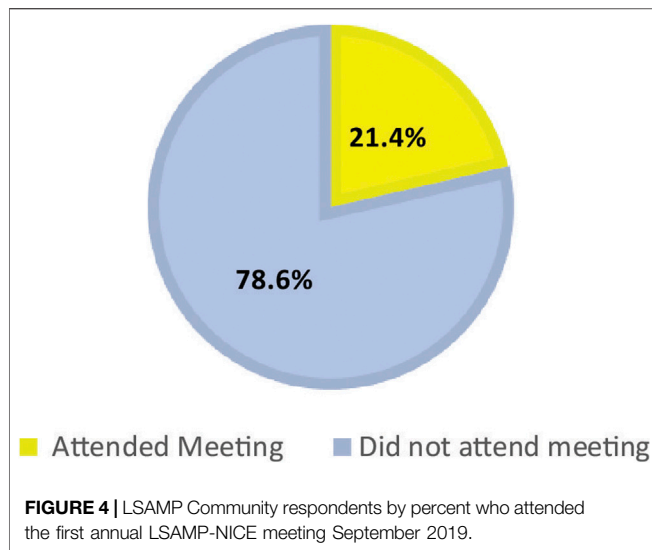
EXISTING LSAMP COMMUNITY INTERNATIONAL STEM PARTNERSHIPS

Central to this study was gaining insight on the number of international STEM research partnerships currently existing in the LSAMP Community which serves underrepresented minority STEM students and, if needed, to map strategies to increase this



number. Thirty-seven (37) respondents replied to the question on the number of international STEM research partnerships. Nearly half, 48.6%, of the respondents reported having international STEM research partnerships with the number of these partnerships ranging from one to ten (1–10). Nearly one-third (29.7%) of the respondents did not have any international STEM research partnerships. Two respondents reported emerging international STEM research partnerships (see **Supplementary Table S2**). This data can be useful to LSAMP-NICE in expanding the number of international STEM research partnerships by tapping the knowledge and skills of leaders of those Alliances with existing partnerships in developing and delivering regional workshops and offering consultation to Alliances on strategies that are useful and effective in building international STEM research partnerships. Consideration should be given to the size and composition of the Alliances in terms of number of participating institutions, varying missions (community college, baccalaureate, graduate, Tribal, HBCU and institutions that enroll large cohorts of Native Alaskan and/or Pacific Islander students) which can impact an Alliance's number of international STEM research partnerships.

Overall, the data showed different strategies used by the Alliances to establish their international research partnerships or international research opportunities. For example, the WiscAMP (Wisconsin LSAMP) does not have partnerships with international research institutions. However, this Alliance works with the University of Wisconsin-Madison Office of International Programs to connect their students to international research opportunities. Many of their students, through the WINStep Program, have done research in India with the Government of India scientific agencies and with universities in India. The majority of the Alliances reported that they worked directly with their international partners to establish their research partnerships. The expansion of the number of international STEM research partnerships is critical for the realization of the goal of the LSAMP-NICE and for the advancement of global collaborative scientific research. The data from this study (See **Supplementary Table S2**) can be used to identify where assistance is needed and identify LSAMP Community principal investigators with proven success in establishing international research partnerships and who can



provide consultation and guidance to alliances who may want to establish or increase their international STEM research partnerships. The linkage of LSAMP-NICE with this leadership group could provide a readily accessible cadre of LSAMP Community knowledgeable who can help diffuse (Rogers 2003) workable strategies on international partnership development which will be embraced by the LSAMP Community. This can help more underrepresented minorities to gain STEM international research experience, LSAMP-NICE to achieve its primary goal and could expand the body of knowledge in STEM research, internationally.

Introduction to LSAMP-NICE

Respondents were asked how they learned about LSAMP-NICE. Twenty-four responded with answers including visits by the former LSAMP-NICE principal investigator to their Alliance, information from a current LSAMP-NICE CO-PI, networking with colleagues, and having an LSAMP student participate during the 2019 LSAMP-NICE Annual Meeting (See **Supplementary Material S1**). All responses reflect direct interaction with individuals knowledgeable of LSAMP-NICE which enhanced the LSAMP-NICE diffusion process.

How LSAMP-NICE Can Be Helpful to Alliances:

Respondents were asked to share their ideas on how LSAMP-NICE can be helpful to them in forging more international STEM research partnerships (see **Supplementary Material S1**). Thirty-seven participants replied. The answers included 1) “everything,” 2) forging relationships with institutions abroad so that their students can pursue summer and long-term research experiences hosted by those institutions. 3) becoming a partner with LSAMP programs, 4) assisting in finding research experiences for students in Alliances in the Pacific Region, especially those from two-year colleges where faculty often have major teaching responsibilities and limited time for research; 5) assist in writing proposals for an IREU or IRES and 6) provide technical assistance on applying for international travel funds. The respondents’ willingness to share

the type of assistance that they need from LSAMP-NICE or that LSAMP-NICE can help broker for them are compatible with the overall purpose of LSAMP-NICE. This compatibility of the LSAMP Community’s purpose and strategies with LSAMP-NICE’s purpose creates fertile ground for collaboratively partnering to increase the number of international STEM research partnerships through using more in-person diffusion strategies and by engaging very successful LSAMP Community P.I.s to share their own as well as the LSAMP-NICE strategies to help increase the number of international STEM research partnerships.

CONCLUSION

This exploratory study was conducted to describe the services provided by LSAMP-NICE, a National Science Foundation (NSF) funded Center of Excellence, to the LSAMP Community, a group of 56 NSF funded Alliances located on college and university campuses to deliver STEM research enrichment programs to underrepresented college and graduate students. The Center’s primary purpose is to help the Alliances increase the number of international STEM research partnerships and thereby increase the number of underrepresented minority students, graduates and faculty who gain the benefit of an international perspective on their research while also broadening their pool of STEM colleagues.

We found that LSAMP-NICE’s major outreach and strategy to diffuse information to the Alliances was by digital and mass media including a website, an advertorial in two issues of a science related journal and an annual national meeting. We found that most respondents had not used these resources and concluded, after reading respondents’ recommendations, that the Center of Excellence should consider adapting more in-person and targeted strategies to diffuse its services. We also found a rich reservoir of talented Alliance program directors within the respondent group in terms of their success in developing international STEM partnerships; however, they were in the minority. We concluded that these Alliance project investigators could be engaged by the Center of Excellence to mentor and consult with those Alliances who have none or few (1–3) international STEM partnerships. From recommendations made by Alliance respondents, we concluded that when planning workshops and in-service sessions for and with Alliance groups, attention should be given to regional differences within the alliances, size of the alliance, as well as the number of years with NSF LSAMP funding. We also found, from responses to open-ended questions, that among those respondents who knew about the overall service of LSAMP-NICE, most had learned from a personal visit by the LSAMP project director, information from a Center of Excellence co-project director, or from a colleague . . . all underscoring the impact of “The Buzz” (Rosen, 2009) and personal contact in diffusing the Center of Excellence’s purpose and services. Respondents from two-year colleges shared a need for the Center to offer recommendations on how to engage 2-year colleges, faculty, and students in international collaborative research given the special mission of two-year colleges. We also concluded that the workshops to diffuse the LSAMP-NICE concept and services should be planned in consultation with the respective Alliance groups. Topics should include ‘Strategies in Building International STEM Research Partnerships as well as

assistance in developing fundable proposals to help underwrite the embedded and cost prohibitive expenses associated with international programming and travel.

Finally, we concluded that LSAMP-NICE has a clear and needed goal which is to help increase the number of international partnerships for the NSF-funded LSAMP Alliances and in doing so help to increase the pool of underrepresented minority STEM students, faculty and graduates who can expand their network of collaborators, add international research experience to their portfolio, and contribute to the STEM international database.

DATA AVAILABILITY STATEMENT

The original contributions presented in the study are included in the article/**Supplementary Material**, further inquiries can be directed to the corresponding author.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by Richard Walker, University of Arkansas at Pine Bluff. Written informed consent for participation was not required for this study in accordance with the national legislation and the institutional requirements.

AUTHOR CONTRIBUTIONS

MB was responsible for the conceptualization of the research proposal, design of the survey instrument, analysis of data and

writing of the article. She was also responsible for identifying the research assistants and for maintaining contact, jointly and individually, with the Co-PIs. DY was the sounding board as the problem was conceptualized, shared her extensive knowledge of the LSAMP Community and during the analytical stage shared her rich background in building STEM international research MOUs and partnerships. She was critical in helping to identify databases from which the study group was drawn. Her proofreading was an asset. SD is an experienced LSAMP program director and the current P.I. for LSAMP-NICE. His commitment to the goal of LSAMP-NICE and his willingness to endorse this exploratory research were assets as we launched the data gathering process. His use of the findings and conclusions from this study could be beneficial in building a larger and more diverse group of United States underrepresented minorities with STEM international research experience.

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SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/feduc.2021.668232/full#supplementary-material>

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