NSA Application Cover Sheet

Women in STEM Research Grants

PROJECT DIRECTOR(S)

Dr. Zoe Gardner

INSTITUTION

Research Institute for STEM Education

The University of Oklahoma

APPLICATION INFORMATION

Title: **Equity Training Module**

Grant Period: **2 Years**

Field of Project: **STEM**

Description of Project: **As more women enter the area of STEM, barriers remain, reflecting the difficulty of women pursuing success in their careers and the outcome of many women opting out of their chosen field of study. This project will rather address the problem regarding retention of women within the STEM field instead of propelling recruitment by evaluating adverse learning and working environments. The achievement of this solution will be accomplished by enforcing an applied practice of equity training, the utilization of a module, to an academic institution. The module will provide education concerning the importance of a diverse, accepting workplace throughout an individual bias survey. This module will lead to awareness and a sense of ease and belonging for women in their own workplace, as well as a push for federal agencies to implement practices and policies themselves. Individual bias survey results will be observed at this institution to offer a baseline of success and identify areas for improvement. The institution's culture and climate are predicted to improve results from a request of $10,000.**

BUDGET

Outright Request **$10,000**	Cost Sharing **$0**
Matching Request **$0**	Total Budget **$10,000**

Total NEH **$10,000**

Table of Contents

Abstract **3**

Statement of Need **4**

Goals and Objectives **6**

Plan of Work **7**

Project Evaluation and Deliverables **10**

Budget and Justifications **11**

Timeline **12**

References **13**

Abstract

As more women enter the area of STEM, barriers remain, reflecting the difficulty of women pursuing success in their careers and the outcome of many women opting out of their chosen field of study. This project will rather address the problem regarding retention of women within the STEM field instead of propelling recruitment by evaluating adverse learning and working environments. The achievement of this solution will be accomplished by enforcing an applied practice of equity training, the utilization of a module, to an academic institution. The module will provide education concerning the importance of a diverse, accepting workplace throughout an individual bias survey. This module will lead to awareness and a sense of ease and belonging for women in their own workplace, as well as a push for federal agencies to implement practices and policies themselves. Individual bias survey results will be observed at this institution to offer a baseline of success and identify areas for improvement. The institution's culture and climate are predicted to improve results from a request of $10,000.

Statement of Need

The fields of science, technology, engineering, and mathematics (STEM) continually bring innovation and improvements to our daily lives as well as offer the potential for expansion of business and employment[1]. Yet women are vastly underrepresented in STEM jobs and among STEM degree holders despite making up nearly half of the U.S. workforce and half of the college-educated workforce[2].

While the world has seen substantial progress in reducing gender discrimination, barriers that keep women out of STEM disciplines persist. This takes the form of barriers ranging from implicit bias and subtle stereotyping to willful ignorance and blatant discrimination[3]. While other challenges exist, a negative work environment directly contributes to the shortage of female representation in the sciences. This problem does not only hinder half of the world's population, but it also hinders the workforce itself. Diversity within an organization or team, including gender diversity, is associated with improved productivity, creativity, and organizational sales and profits[4]. While there may be a general acknowledgment that assembling more women would enhance possibilities within the realm of STEM, the unexploited opportunity to boost these jobs for women in the United States remains.

The approach to push more women into STEM is nothing new. STEM is a fast-growing, lucrative industry that will maintain the domination of available prosperous jobs in the future, hence why there is such an urge for more women to enter these fields. If these systemic biases are merely tolerated, the economic disadvantages women already have as a class will perpetuate. Confronting the gender gap in STEM will foster economic growth while simultaneously minimizing occupational segregation[5].

Since 2015, the number of women in STEM has grown from 22,020 to 24,705 in 2019. This data provided by the Higher Education Statistics Agency concludes that on the surface this would appear to show a linear increase, however, due to the more rapid growth in the number of men graduating in these subject areas, the percentage of women in STEM has fluctuated from 25%, down to 24%, and finally up to 26% where it has stalled in 2019[6]. Concurringly, a comparison study found that after about twelve years, 50% of women who originally worked in STEM have exited and are employed in other fields. In contrast, only about 20% of women in other professional occupations exit throughout the course of the study, which spans almost thirty years for some women[7]. These statistics convey that while the existing transformative programs and encouraging actions to recruit more women into STEM are partially effective, they are not the solution. A refined mission is needed to shift focus on retention, not recruitment, is needed. Nobody wants to work in a place that does not serve them, and more women will naturally gravitate towards STEM once these obstacles are eliminated.

For now, society should work to alleviate the barriers that deter women from STEM pathways. Whether it is due to isolation caused by a lack of women peers, role models, and mentors or futile feedback due to their contributions being ignored, many of these issues start with gender

stereotyping and bias in the workplace. Thus, it is imperative to introduce equity training throughout the practice of a module to STEM employees, which in return will provide first-hand, further insight into how the workplace needs to adjust. This grant proposal seeks to assist in providing solutions for the gender gap in STEM through an individual bias survey developed to inform employees on the value of an inclusive, respectful workplace and spread awareness on how stereotypes and bias can impact behavior in the workplace. The National Science Foundation prioritizes discovery, learning, research infrastructure and stewardship, as this grant proposal will by uncovering evidence and insight from project results to lead towards a further investigation into retention while leading the future of STEM towards a beneficial path.

Goals & Objectives

Goals

- To ultimately help eliminate the gender gap of women in STEM and improve graduate education
- Encourage other institutions to adopt the same practice of a module
- Create an adjusted alignment of institutional culture and climate
- Empower other institutions to improve and modify their STEM workplace

Objectives

- Foresee improvement of women in retention and attraction towards STEM at our institution from the first to the second year
- Foresee improvement of answers regarding employees' feelings towards stereotypes and bias in the survey from the first to the second year
- Find insight on cultural and social implications towards behavioral attitudes towards stereotypes and bias
- Be able to identify some of the best practices from comparing the results from each year and sharing this evidence with other institutions

Plan of Work

The equity training module proposes increased morality and representation in STEM fields and careers. Further contributions of research will be rendered from this innovative approach, all while taking a developmental educational approach towards those who are in STEM. It will be moderated by the Research Institute for STEM Education (RISE) at the University of Oklahoma. As this is a constantly evolving world that is becoming progressively tech-related, the importance of STEM is acknowledged. At this academic institution, each STEM component is valued, for it prepares individuals to benefit society via creativity and durable solutions.

As discussed, acts to recruit more women into STEM proceed to transpire. Since STEM pathways may be intricate, attempts of broader access and early-to-late recruitment stay in demand. The gender gap prevails, but now, a progression of acts towards the retention of women in STEM is evolving. At the University of Oklahoma, many STEM initiatives have been implemented, ranging from inclusive activities, workshops, presentations, to communities. The RISE has made accomplishments, specifically from projects that withheld a corresponding end goal alike the equity training module. For instance, one research proposal questioned a circumstance: the success of gender equity in industrial engineering at the University of Oklahoma. Gender equity is proclaimed in this department because of the high proportion of female undergraduates and faculty[8]. In this former research project, the RISE conducted a unique approach. Such abnormal statistics were utilized to produce experimental factors as to why problems remain even in a department that holds a substantial number of women. Despite only comprising a portion of the STEM field, the advantageous data poses underlying factors that women face in all STEM disciplines. The scrutiny of our past research at the RISE led to experience and ingenuity to promote a solution. Thus, to confront stereotypes and bias, a probable underlying issue, throughout the creation of a module.

The equity training module's eventual aim is to foresee the retainment of women in STEM majors by adjusting the alignment of institutional culture and climate. The plan to achieve this retention will be a process of educating and researching STEM students' apprehensions throughout a module at the University of Oklahoma. It will be distributed to all students involved in STEM.

As this is primarily for college students, I, Dr. Zoe Gardner, am informally writing this module to pertain to the target audience. This is not only to keep the users engaged, but also to avoid skewed results from a lack of concentration. The equity training module begins with introductory questions asking for a participant's gender, race/ethnicity, disabilities, and STEM discipline. All identities of participants will remain confidential. These questions are merely necessary to have disaggregated data collection, as it provides a better understanding and insight into a participant's experience. Disaggregated data allows RISE to share recommendations and results of our practice.

The first part of the equity training module consists of educational information on the barriers that exist for minorities in STEM. Most specifically, the stereotypes and biases towards women in the workforce. The learning objective for participants should be an understanding of how internalized stereotypes and biases can cause a harmful institutional culture. This part appears straightforward, but it is necessary in order to combat learned misconceptions.

The second part of the equity training module consists of brief educational information emphasizing the importance of a diverse, accepting workplace. The learning objective for participants should be understanding the depths of a harmful institutional climate. The reading will transcribe that inclusion leads to a women's awareness, satisfaction, and sense of belonging in their own workforces.

The individual bias questionnaires will appear after each educational information is read all the way through. After that, a participant selects their chosen answers from a list of multiple-choice questions. If the incorrect answer is selected, the correct answer will be immediately relayed back to the participant. Some questions may provoke an opinionated response, so not all questions will have a correct answer. All results from the introductory questions and questionnaires are recorded to document a baseline of success and reveal areas for development. It stands confidential, just as the personal questions, allowing participants to state their true apprehension of bias and stereotypes in the workplace.

I, Dr. Gardner, am planning the implementation of this equity training module. A multitude of researchers affiliated with RISE, such as other directors, collaborating faculty, national and local advisors, a post-doctorate associate, and multiple graduate and undergraduate students, all will contribute to developing and distributing the online modules. Members of the RISE will use Qualtrics, an online survey software, to gather data and later again to execute institutional research and publish reports. Qualtrics is to be deployed by RISE to compare measurements such as fluctuations or trends throughout the two years.

In the two-year funding period, there is a pre-test and a post-test at the beginning and end of each school year to measure the students' comprehension. The pre-test module must be submitted electronically by the completion of the first week of school. The post-test module is not due until the completion of the last week of the following semester. All four tests undergo the same process, but the second year will yield more insight. The strategy of receiving status that is up to date allows for a well-monitored comparison to be drawn between the two years. The Research Institute of STEM Education (RISE) will send a link to the module via Canvas inbox to all STEM students. STEM faculty at the University of Oklahoma will be made aware of this change, as they are required to mention this implementation to all students.

RISE at the University of Oklahoma is suitable to conduct the equity training module over the course of two years. The STEM program at this institution is large, and it can cover all staff and board members needed. Also, the research program has previous experience concerning the target population. As this project will be online, no other physical resources are needed. The

finances of this proposal are considerably cheaper than other solutions. Most other options refer to many acts of recruitment that require a lot of funding. An online equity training module created for an institution by its own faculty is one of the most inexpensive routes to take. The expertise of those in the RISE is shown through proof of success in similar studies. A critique of this module may be that students may simply speed-run the reading portions and randomly click answers. While this is a legitimate concern, a computer will read aloud the reading portions to find an estimate of how long each sentence takes to read.

While this is a two-year funding period, the University of Oklahoma will meet whatever needs necessary to spread the use of the equity training module. This is a program that intends to spread the use of this practice to other institutions nationwide. If given time, the equity training module can be a push for federal agencies, too, to implement practices and policies themselves. If this module were to reach no solution after two years, there is no doubt other organizations would collaborate. The gender gap in STEM has stayed for a while, therefore there will be collaborators out there. The equity training module is not just a tool to solve the retention rate of women in STEM, it is also an educational implementation that seeks to acknowledge the support for women needed inside of STEM.

Project Evaluation and Deliverables

Evaluations

Within the equity training module, there is an individual bias questionnaire regarding educational information about women in STEM. The survey will allow The Research Institute of STEM Education (RISE) to scout out for areas for improvement. Metrics of success will be performed by Qualtrics, an analysis tool. Qualtrics will be used by RISE personnel to compare four-module training tests over two years. The comparison will show the result of whether an improvement in student attitudes towards stereotypes and bias occurred. For insight on cultural and social implications, this will be monitored through concise data collection. All answers will be cross-referenced with other answers to gain insight. Regarding a prediction to see retention and attraction towards women, the disaggregated data will show whether there is an increase in numbers or not. To identify some of the best practices from each year, the first-year results may be altered slightly. A close watch of different responses will be monitored.

The purpose of these evaluations is to ultimately provide insight towards further research. The funding institution, the National Science Foundation, will receive two reports for this project. The first report will convey further suggestions from our data collection following from the beginning to the end of the year. Possible changes may be inducted. The second report will be the same, but it will be more finalized with a more accurate data collection.

Deliverables

RISE seeks to spread awareness while evoking more research by producing an equity training module. As the module is online, the module itself is on a website, a deliverable. The timeline for the use of this website is the due weeks of each four modules. However, the website can be available to share with other institutions that wish to collaborate and use the module as well. The website of our online module will be spread through publications. Soon, other research, such as journal articles and reports will come from this current research.

An implementation of a mandatory module specifically designed for an industry is a policy itself. Part of the module will address policies such as diversity and awareness within STEM. For the second deliverable, a policy, its timeline can be indefinite as well. These policies could be used by other institutions as well. Some of the same policies could even be used towards something unrelated to STEM. Policies would be shared through training materials between the University of Oklahoma and other institutions.

The module is designed to educate students on the issues of stereotypes and bias towards women in STEM and to provide information on social and cultural implications. Thus, the third deliverable: more informed and considerate STEM students, due to the exploitation of an educated practice. The timeline for more informed and considerate STEM students is undetermined. This relies on whether the equity training module will continue or not. More informed STEM students will lead to developments to end the gender gap.

Budget and Justification

Item	**Cost**	**Description**
Website	$3,000	All the factors include content that helped create the e-learning module, such as contents, process discipline, and the creation.
Salaries	$700	Everyone that was involved in the RISE.
Publication Costs/Dissemination	$1,000	This refers to the publication costs that will help disseminate research findings after the project.
Computer Services	$1,500	This refers to time spent on the computers covering the software needed to run data.
Participant Costs	$500	For inconveniences, a participant may face while trying to take the survey.
Stipend	$10,000	The cost of paying four graduate research assistants a stipend for a year because they will oversee managing the entire project.
Total	**$16,700**	The cost of the entire project.

Timeline

- The pre-test module is administered to all students in STEM during the first week of school in Spring 2022
- The same post-test is again administered in Fall 2022
- Between the break, reports are published about analyses
- In the second year, a pre-test module is distributed again in the Spring of 2023
- A post-test module is in Fall of 2023
- The module continues to spread nationwide

References

[1] Bilimoria, D., & Lord, L. (2014). *Women in STEM Careers: International Perspectives on Increasing Workforce Participation, Advancement and Leadership*. Edward Elgar Publishing Limited.

[2] Beede, D. N., Julian, T. A., Langdon, D., McKittrick, G., Khan, B., & Doms, M. E. (2011). Women in STEM: A Gender Gap to Innovation. U.S. Department of Commerce, Economics and Statistics Administration. *SSRN Electronic Journal.* https://doi.org/10.2139/ssrn.1964782

[3] Pierce, Margo. (2013). Barriers for Women in STEM. American Association for the Advancement of Science.

[4] Reagans, R., & Zuckerman, E. W. (2001). Networks, Diversity, and Productivity: The Social Capital of Corporate R&D Teams. *Organization Science, 12*(4), 502-517. https://login.ezproxy.lib.ou.edu/login?url=https://www-proquest-com.ezproxy.lib.ou.edu/scholarly-journals/networks-diversity-productivity-social-capital/docview/213826875/se-2?accountid=12964

[5] How Gender Equality in STEM Education Leads to Economic Growth. European Institute for Gender Equality. (n.d.). https://eige.europa.eu/gender-mainstreaming/policy-areas/economic-and-financial-affairs/economic-benefits-gender-equality/stem

[6] *Women in STEM: Percentages of Women in STEM Statistics*. STEM Women. (2021). https://www.stemwomen.com/blog/2021/01/women-in-stem-percentages-of-women-in-stem-statistics

[7] Glass, J. L., Sassler, S., Levitte, Y., & Michelmore, K. M. (2013). What's So Special About STEM? A Comparison of Women's Retention in STEM and Professional Occupations. *Social Forces, 92*(2).

[8] *Why Does It Work? A Study of Successful Gender Equity in Industrial Engineering at the University of Oklahoma.* Research Institute for STEM Education. (n.d.). https://rise.oucreate.com/nsf-gender-grant/