Experiences of Nuclear Workforce Pipeline Development and Maintenance at a Historically Black College University (HBCU)

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Abstract

Our HBCU has a well-established record of providing quality college and pre-college programs in most academic disciplines in the state and the nation. We present our on-going experiences in the development and implementation activities that are designed to increase the number of underserved minority students interested in STEAM programs in nuclear science and technology. The impact of our activities in addressing the challenges and providing skills developed and utilized in the implementation of our project frameworks of SUpporting Strategic Training of Adaptable and Integrated Nuclear (SUSTAIN) Workforce funded by Department of Energy (DOE), Experiment-Centric Pedagogy (ECP), funded by National Science Foundation (NSF) and Homefront Factors Study funded by our school, has led us to some innovative and practical solutions that need to be enhanced and supported. Our initial activities include experiential learning and research; collaborating and making use of advanced nuclear technologies from our SUSTAIN team member resources; interaction with professionals working in the nuclear energy industry and our students field visit to our Majority Institution collaborators; provision of skills to K-12 teachers, parents and adult family members who work with and encourage and motivate their scholars in STEAM activities and nuclear science programs. These activities have resulted in our deeper, sustained student engagements and understanding of some mitigating factors that our scholars face and need to be addressed to enhance a nuclear workforce pipeline at an HBCU. We report on our initial activities of access to technology, housing, employment, family responsibilities, teamwork, security, and mentorship, herein referred to as Homefront Factor studies, local institution community mile linkages, out of state community outreach and our preparation of in-person Saturday academy that includes a series of weekly hands-on activities. Students have been engaged in a variety of "*hands-on, minds-on*" STEAM activities that are aligned to the National Math, Science, and Technology standards and learn about different Nuclear Energy University Program (NEUP) careers in STEAM as they delve into each grade level project.

Key Words: Supporting Strategic Training of Adaptable and Integrated Nuclear Workforce (SUSTAIN); Nuclear Energy University Program (NEUP); Local Institution Community Linkages and Outreach; Pipeline Development; Family Forum Café; Historically Black College University (HBCU); Experiment-Centric Pedagogy (ECP); Science, Technology, Engineering, Arts and Mathematics (STEAM).

Introduction

The overall goal of our project is to identify existing and future gaps in our country's nuclear energy workforce and to bring to the pool a trained workforce of minority students graduating from our HBCUs. This is important because the Board on Higher Education and Workforce (BHEW) at the USA National Academies of Sciences Medicine and Engineering (NASEM) continues to provide the academic community, policymakers, and businesses with insights and recommendations on critical higher education and workforce issues facing our nation [1]. Secondly, BHEW previously identified that the educational outcomes and STEM readiness of students of color will have direct implications on America's economic growth, national security, and global prosperity [2]. Thirdly, the nuclear energy workforce gap analysis in the USA is expected to include the full range of existing and potential variations in U.S. nuclear reactor technologies (current and future) plus the nuclear fuel cycle [3]. Fourthly, in nuclear workforce development, our team has embarked on studying those unique challenges and diverse lived experiences of our minority students that they bring to our learning environments away from home and has formed part of our Institution Transformation 2030 Strategic Plan. These lived experiences include needs for technology [4], shelter, income-earning activities, family care [5], teamwork, mentorship and security, herein referred to as "Homefront factors". We have been examining the impact of these factors on our student-instructor interactions since 2019 and have shared some insights of our qualitative analysis in various forums. Fifth, little is known about how Homefront factors influence interactions between students and their instructors. A Likert grading method of six (6) components was developed and used to evaluate the qualitative data gathered from student Canvas messages. The six main components of the assessment were: preparation, respect, human behavior, social structure, greetings and salutations, and request specification. With a focus on scholarly preparedness and impact for academic success for minority nuclear workforce development, our study seeks to provide light on trends in metrics pertaining to student interactions. This research is crucial in bridging the existing knowledge gap and fostering a deeper understanding of the intricate dynamics between Homefront factors and student-instructor interactions for minority nuclear workforce development. Sixth, we present our on-going experiences in the impact of our activities that address the challenges and providing skills developed and utilized in the implementation of our project framework of SUpporting Strategic Training of Adaptable and Integrated Nuclear (SUSTAIN) Workforce. SUSTAIN activities [3] include: (1) analyzing the way other students are dealing with their Homefront factors, are energized to go and share with others; (2) local and out of state community outreach activities undertaken in the participation of our students and faculty at a Career Day activities of some local Elementary, Middle and High Schools plus an out of state visit to a Majority Institution that has nuclear facilities for our student exposure to nuclear workforce development programs, planning and lived experiences; (3) in-person Saturday academy that includes a series of weekly hands-on activities shown in Task 4[3] and the application form running from February 10, 2024, to March 16, 2024; (4) Saturday academy (Task 4) showing specific aims, activities and proposed timeline. It is drawn from five (5) Task 4 goals: (i) Focus on K-16 STEM pipeline reinforcement, undergraduate and graduate level activities, development of new academic programs and certificate courses, (ii) Professional Development (PD) for K-16 teachers and administrators (both in per-son and online/remote), (iii) In-Classroom Implementation, (iv) Weekend Classes and Family Forum Café, (v) Outreach and Field Trips; (5) the Family Forum Café is interactive and provides STEAM education and parenting information to any supportive, adult role models that the scholar might have. The Family Forum Café also puts the adult in touch with other local resources and STEAM programs that are available for their scholars. Typically, the Family Forum Café meets for 3-hour

sessions on pre-determined Saturdays during the current SUSTAIN session. Parents are required to participate in no less than 3 sessions.

Finally, our project is funded by the Department of Energy (DOE), Experiment-Centric Pedagogy (ECP), funded by National Science Foundation (NSF) and Homefront Factors Study funded by our school. All have led us to some innovative and practical solutions that need to be enhanced and supported. Our HBCU team is addressing Task 4 as shown in Table 1.

Table 1: Project Tasks Overview [3]

		Outcomes
Meta-Analysis	Task 1-1: Lessons-learned from previous workforce evaluations in the nuclear industry Task 1-2: Lessons-learned from previous workforce evaluations in critical support fields Task 1-3: Leveraging and updating best practices for workforce evaluations	• Foundational analysis to synthesize insights from and applicability of previous nuclear workforce evaluations • Assessment of state of workforce in critical support fields and industries competing for skilled workers • Establishment of strategies and practices to guide subsequent project activities
Strategic Outreach	Task 2-1: Industry, national laboratory, and government agencies Task 2-2: Potential workforce/workers Task 2-3: Universities, educational institutions, and training agencies	• Identification of needs, challenges, and opportunities across organizations involved in the nuclear industry/fuel cycle • Understand workforce demand parameters and expectations • Identify workforce/worker expectations • Leveraging education and training to link supply with demand
Projection & Assessment	Task 3-1: Projected readiness and timelines for multiple scales and reactor technologies Task 3-2: Projected needs/changes across nuclear fuel cycle Task 3-3: Gap analysis/specification of workforce needs (with uncertainty)	• Integrated gap analysis to establish workforce needs accounting for (1) insights from industry, (2) projected future of nuclear reactor technologies/fuel cycle, and (3) the potential for other industries to compete for skilled workers • Assessment of uncertainty in future needs through scenario-based planning
Content Development	Task 4-1: Incorporation of gap analysis results into opportunity context Task 4-2: K-12 content development Task 4-3: Community college and trade schools Task 4-4: Undergraduate and postgraduate education Task 4-5: Re-training, cross-training and certification Task 4-6: General Purpose	• Translation of insights from gap analysis into strategic plan for content development • Development of formal educational content and enrichment programs for K-12 schools, community colleges, trade-schools, undergraduate, and post-graduate programs • Creation of content to facilitate transition of experienced skilled workers and tradespersons to the nuclear sector • Development of general educational content to communicate the advantages of nuclear power and the possibilities of a nuclear career

The dynamics of the team are a microcosm of the whole campus environment and serve very well to enrich the work and the quality of work being done. Students taking part in this research, after analyzing the way other students are dealing with their Homefront factors, are energized to go and share with others. This study underscores the crucial need of addressing Homefront factors in our education delivery, especially when dealing with pandemics, which can dramatically influence student-instructor interactions and academic performance in nuclear workforce development. To improve student access and support education delivery services, there is, therefore, a great need to focus more on the Homefront factors among other inherent school and community activities. Future work includes integrating our public datasets that address Homefront factors in our school and society.

Local and out of state community outreach activities undertaken include participation of our students and faculty in the Career Day activities of some local Elementary, Middle and High Schools plus an out of state visit to a Majority Institution that has nuclear facilities for our student exposure to nuclear workforce development programs, planning and lived experiences.

The inclusion of students' communication on Canvas messaging, Career Day activities, Saturday academies, and Family Forum Café relate to our initial research bridging the existing knowledge gap and fostering a deeper understanding of the intricate dynamics between Homefront factors and student-instructor interactions for the success of our minority nuclear workforce development. Our initial Homefront factor studies [6, 7] showed that 51% (47 of the 92 students who took part in one of our initial studies) indicated lack of scholarship/funding as their main challenge. Around 60% of these students reported also that they worked for more than 10 hours a week, reducing the time spent on education to less than 10 hours per week. The role these factors play on the successful implementation of our SUSTAIN project is governed by transforming the challenging Homefront factor circumstances into the 3C attributes (competence, character and connection) that will be continuously investigated, presented and discussed as proposed in our project [3] plus BHEW previously identified that the educational outcomes and STEM readiness of students of color will have direct implications on America's economic growth, national security, and global prosperity [2].

Study Methods

A. Training and Motivation

To train, encourage and motivate students for workforce development to pursue nuclear science and technology careers and jobs in our communities, our HBCU team is working on its assigned Task 4 [3]. This is part of the Strategic Outreach for Nuclear Workforce Pipeline Development and Maintenance. The objectives include the following:

1. *Increase the number of historically underserved and underrepresented students interested in nuclear science and technology, engineering and DOE specific STEM careers.*
2. *Engage students in hands-on experiential learning and research, using advanced nuclear science technology, exposure to professionals working in the nuclear energy industry, and*
3. *Provide skills to parents and adult family members to work with and encourage their children in STEM activities and nuclear science programs.*

Our team is also providing additional node for our HBCU Office of Technology Transfer to promote the concept of business application of nuclear reactor technology and research to faculty, staff and students, encourage and support the development of new and innovative nuclear technology products.

B. Metrics of Focus Areas for Strategic Outreach

The metrics used to assess the effectiveness of our strategic outreach efforts are shown in Outcomes (Table 1). Our initial activities include (i) experiential learning and research, (ii) using advanced nuclear technology, (iii) exposure of our students to Majority Institutions with nuclear facilities and professionals working in the nuclear energy industry, and (iv) provision of skills to K-12 teachers, parents and adult family members to work with and encourage their children in STEM activities and nuclear science programs [8].

First, our project is using the results of gap analysis to develop responses and strategies to address nuclear workforce pipeline needs. These responses are multicomponent and do incorporate all team members from five institutions and DOE. Secondly, to address the development and implementation of the stated goals, our HBCU team together with some other Majority Serving Institutions (MSI) and private sector, are implementing this DOE manpower development project designed to increase the number of underserved minority students interested in STEAM programs in nuclear science and

technology. It is therefore hoped that our outcomes will act as templates for (i) the development of curricula, courses, certificates, experiences, and (ii) opportunities to initiate, develop, and train the future nuclear workforce in our institutions and the country at large.

C. Mentoring Diverse Groups of Students

As part of this project, our HBCU faculty team has mentored and supervised students of diverse backgrounds - race, gender and academic levels. The students were five (5) undergraduates, four (4) graduates and two (2) postgraduates from different departments and schools. The team learned to advise these students on issues pertaining to academic excellence, work scheduling, priorities, peer pressure, finances, responsibilities and consequences of choices made. Students supervised by the team have excelled in their project activities by publishing their work, participating in various local and international scientific conferences within and outside of our institutions as depicted in our conference posters. Some students have applied to continue to graduate school, and nuclear workforce training at other academic institutions in the country. The experience gained by the team in supervising a diverse group of students such as those found at our HBCU has strengthened the team in this project. Building teams such as this will go a long way towards the success of strategic transformation of our HBCUs.

D. Homefront Factors [9]

Student success and well-being in nuclear workforce development and our *2030 institutional transformation strategic plan* is heavily impacted by Homefront factors herein defined such as needs for technology [4], shelter, income-earning activities, family care [5], teamwork and security. We have been examining the impact of these Homefront factors on student-instructor interactions since 2019 and have regularly been sharing some insights of our data analysis in various forums. One thousand and five (1005) Canvas messages from 2019 to 2023 [8] were scored using the multi-element scoring tool (Table 3). This dataset covers the period before, during and after COVID-19 pandemic.

Table 3: Multi-element Scoring Tool and Examples of Canvas Messages Analyzed [14]

Table 3 (a): Multi-Element Scoring Rubric

Element	Score: 1	Score: 2	Score: 3	Score: 4	Score: 5
Greetings and Salutations	*Very impolite*	*Somewhat impolite*	*Neutral*	*Somewhat polite*	*Very polite*
Respect	*Very disrespectful*	*Somewhat disrespectful*	*Neutral*	*Somewhat respectful*	*Very respectful*
Request Specification	*Very inappropriate*	*Somewhat unspecific*	*Neutral*	*Somewhat specific*	*Very specific*
Social Structure	*Very inappropriate*	*Somewhat inappropriate*	*Neutral*	*Somewhat appropriate*	*Very appropriate*
Human Behavior	*Very inappropriate*	*Somewhat inappropriate*	*Neutral*	*Somewhat appropriate*	*Very appropriate*
Preparedness	*Very unprepared*	*Somewhat inappropriate*	*Neutral*	*Somewhat appropriate*	*Very prepared*

Table 3(b): Examples of Some Canvas Messages and their Scores

Unedited Sample Messages	Score 1	Score 2	Score 3	Score 4	Score 5	Score 6
i. *"Hello, I can not find the rubric for the measurement assignment can you please send me a copy of it? Thank you"*	3	3	3	2	3	2
ii. *"Hello There, I wanted to know if our groups 'team leaders are assigned or chosen amongst the group. Also, I wanted to know when this assignment is due. Thanks,"*	1	1	4	1	1	4
iii. *"Good morning Professor, My assignment is not submitting on canvas. Is there an alternative of submission. Thanks,"*	5	4	4	3	3	3
iv. *Hey Prof. the internet at the delta hotel has being going out constantly do you think I can have more time on this assignment?*	3	3	3	5	5	3
v. *Good Morning, Thank you for opening up the assignments. In the allotted time spam I was able to make very significant progress and I will be on the look out for more assignments to drop in the near future. Please have a great day and a great weekend. Best Regards,*	5	3	5	5	5	5
vi. *Hello Mr. Is it possible i can take my midterm while im in another class?*	4	3	3	5	5	3
vii. *Hey, I saw you graded the assignment, but I turned it in late and sent it through inbox?*	2	2	2	2	2	2
viii. *Is there anyway you can help me make up the work I've missed Mr?*	2	2	2	2	2	2
ix. *Mr. while we were doing the quiz i havemt been able to access. I asked for help with this but the lock down browser still didnt let me in.*	2	2	2	2	5	1
x. *'Hi Professor, I just want to inform you that Question 3 was blank on the Midterm:*	4	4	4	5	4	4
xi. *Good Afternoon Professor, Do you have office hours today or this week so I can talk to you about my missed assignments?*	3	4	3	4	3	5
xii*. I wasn't there for the visit to CBEIS building? I'm not sure what this assignment is asking for*	3	1	2	2	3	1
xiii*. Hello Professor, For the past week, I have lost all access to my classes due to financial issues. I would like to know for all the assignments that I have missed will I be able to receive an extension?*	3	4	3	4	4	4

E. Research Design and Data Analysis

We meticulously analyzed the Canvas messages using a multi-element scoring tool, which was developed to evaluate the professionalism of student communications as explained above. The scoring process was developed and conducted by a team of twelve (12) evaluators, that included four faculty members, eight (8) graduate and undergraduate assistants trained to ensure consistency in scoring, data entry and analysis by SPSS software [10]. These evaluators were previously trained and selected for their expertise in communication and their understanding of the academic environment at HBCU.

The messages, spanning from 2019 to 2023, were scored to prevent bias, with evaluators mixed to the year of the messages to ensure an objective analysis. Each message was independently scored by at least two evaluators on a Likert scale [11, 12, 13] from 1 (indicating a lack of professionalism) to 5 (indicating a high level of professionalism). In cases of significant score discrepancies, a third evaluator was consulted to achieve consensus. This rigorous approach allowed us to assess communication trends over time and provided a reliable evaluation of the students' communication skills development towards academic success in nuclear workforce development.

Results and Discussion

For our Homefront Factor studies, we have ten significant findings [14]. First, one thousand and five (1005) Canvas messages from 2019 to 2023 were scored using the multi-element scoring tool (Table 3). This dataset covers the period before, during and after COVID-19. Figures 1 to 6 show the percentages of messages scored for different elements in the years 2019 (296), 2020 (236), 2021 (34), 2022 (412) and 2023 (27) [8,9]. Secondly, over 30% of students began their messages with polite greetings and salutations in 2019, increasing to almost 70% in 2023 (Fig. 1). Thirdly, the same pattern is observed with the respect metric (Fig. 2). Fourthly, the percentage of messages with respect was 25% in 2022 and increased to 74% in 2023. However, it had declined to 14% in 2020. Such a change probably is caused by an increased fear of loss with students being away from their friends and normal social environment, away from the usual learning atmosphere and resources they are used to, and away from their possible form of employment. This is speculated to cause a biological reaction that increases dishonest behavior [15]. Fifth, this study found that Homefront factors do play a significant role in shaping the students' interaction on Canvas as displayed by the scored undertone of their individual experiences. Sixth, the trends shown in the metric request specification tracks very well with that of the metric preparedness (Figs. 3 and 4). Seventh, the percentage of messages showing clear request and demonstrating preparedness were high (70% and 65%) in 2019, decreased in 2020. It then increased to even higher values (74% and 89%) in 2023. Eighth, social structure, only 25% of the student's messages showed projected social inclination and refined ability to relate well in 2019. The percentage increased to about 70% in 2023 (Fig. 5). Ninth, the element human behavior improves to 90% in 2023 from 25% in 2019 (Fig. 6). Tenth, our study indicates a common trend in the six elements analyzed with the scoring tool showing a significant ($p < 0.001$) improvement compared to during COVID-19 period (Table 4).

Table 4: Chi-square Trends (*p*-Values) and Sample Sizes (N_i)

	2019 (N_1=296)	**2020 (N_2=236)**	**2021 (N_3=34)**	**2022**	***(N_4)***	**2023 (N_5=27)**	***Chi-square***	***Pearson's R***	***P-value***	***Spearman correlation***	***P-value***
Greetings and Salutations	<0.001	<0.001	<0.001	<0.001	412	<0.001	92.892	0.174	<0.001	0.085	0.038
Respect	<0.001	<0.001	<0.001	<0.001	406	<0.001	99.766	0.239	<0.001	0.120	0.003
Request Specificity	<0.001	<0.001	<0.001	<0.001	407	<0.001	56.236	0.014	0.726	-0.086	0.037
Social structure	<0.001	<0.001	<0.001	<0.001	409	<0.001	84.468	0.168	<0.001	0.108	0.008
Human behavior	<0.001	<0.001	<0.001	<0.001	408	<0.001	113.368	0.253	<0.001	0.173	<0.001
Preparedness	<0.001	<0.001	<0.001	<0.001	408	<0.001	102.410	-0.019	0.636	-0.162	<0.001

This study underscores the crucial relevance of addressing Homefront factors in the realm of education, especially when dealing with pandemics, which can dramatically influence student-instructor interaction and academic performance. There is, therefore, a great need to focus more on the Homefront Factors to support services and the delivery of education in our institutions among other inherent community activities so to improve student success [8, 9, 14, 16, 17]. Future work includes integrating public datasets that address Homefront Factors in our schools and communities. The impact on our community linkages and outreach activities done so far is pictorially shown in Figures 7 to 16.

Fig. 1: Greetings and Salutations

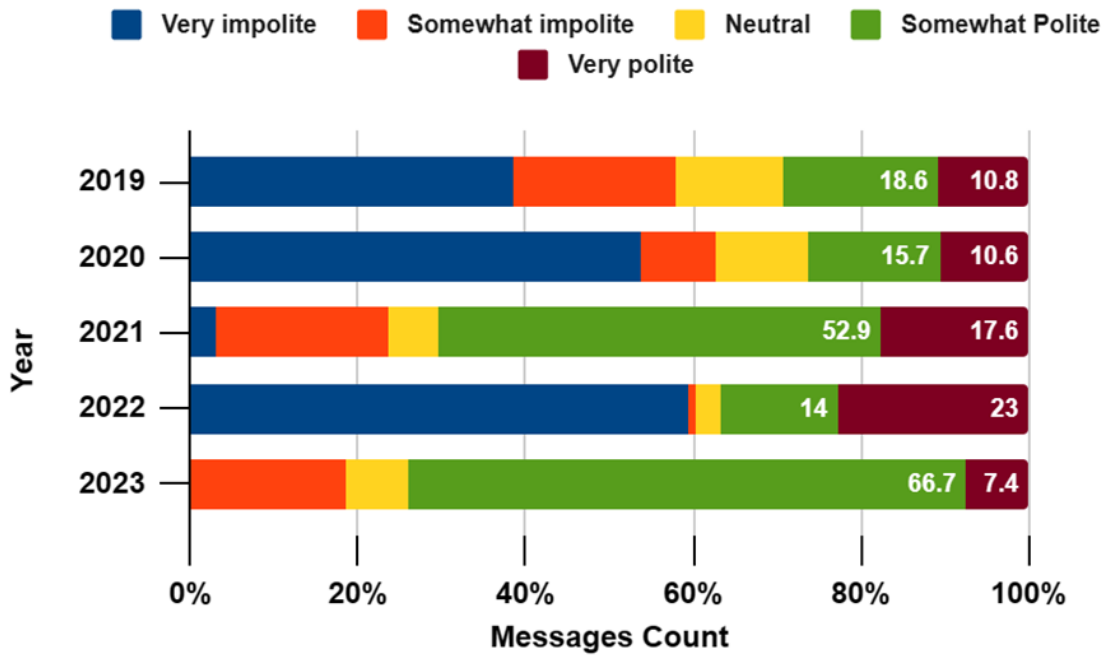


Fig. 2: Respect

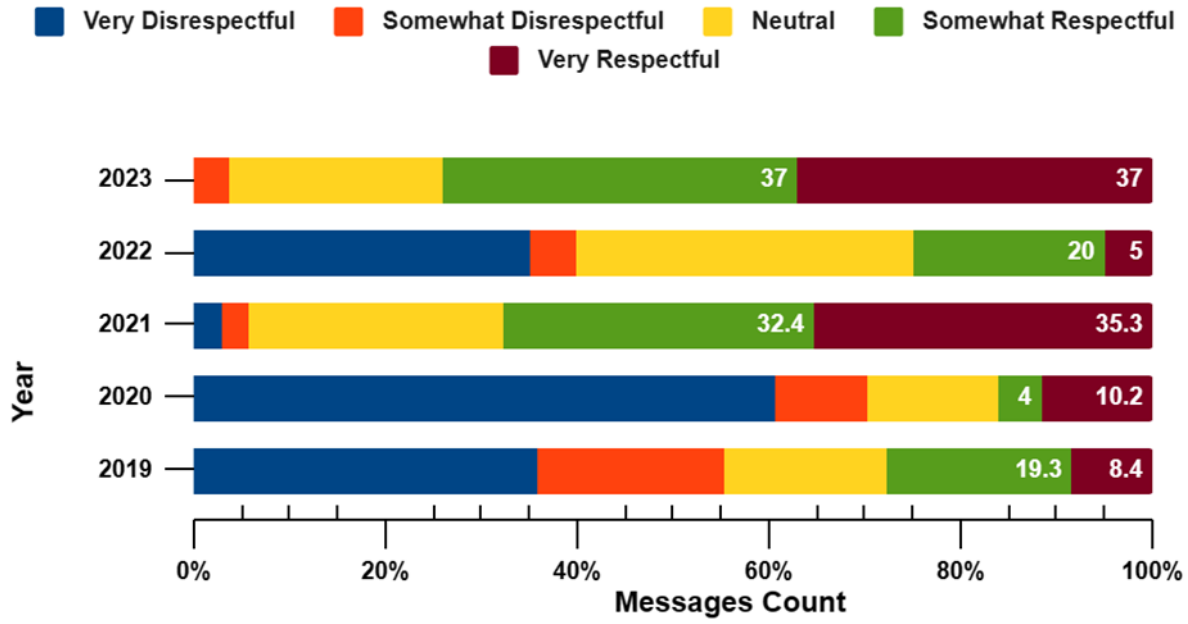


Fig. 3: Request Specification

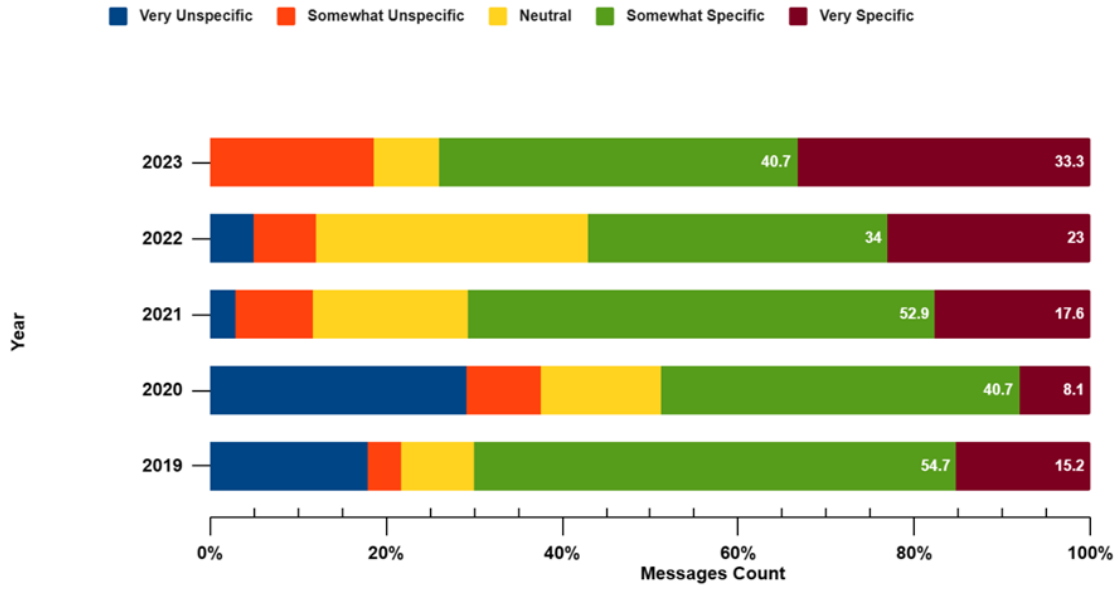


Fig. 4: Preparedness

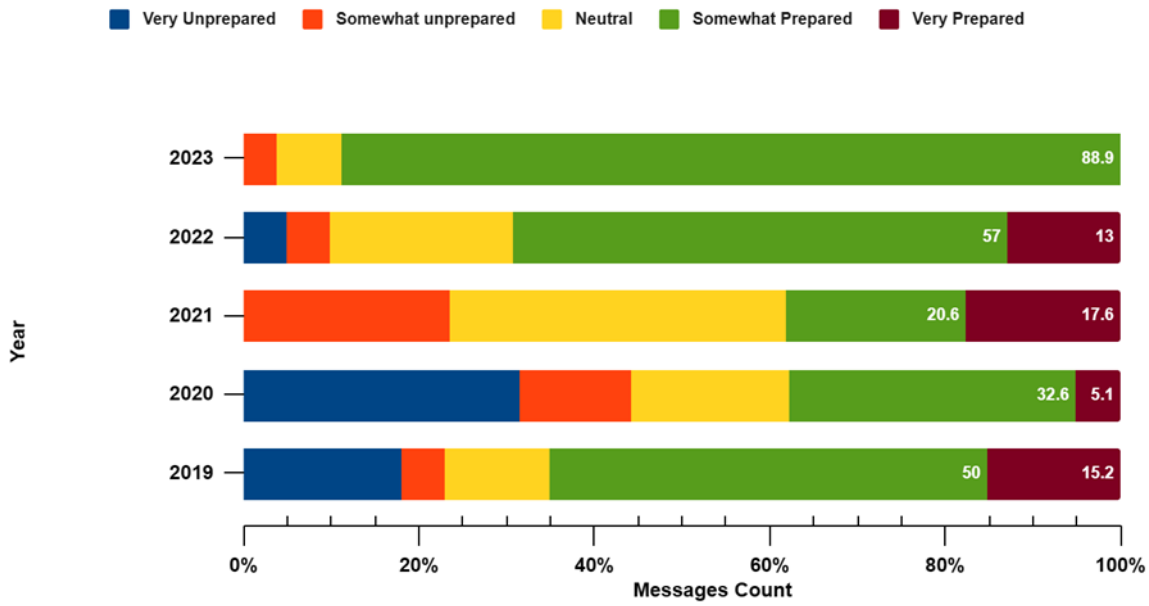


Fig. 5: Social Structure

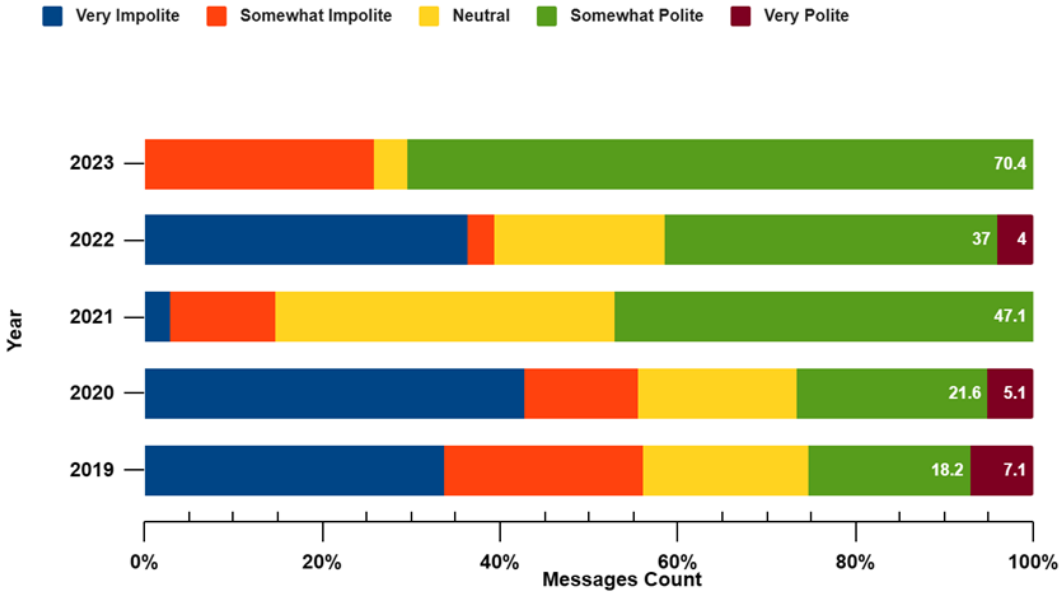


Fig. 6: Human Behavior

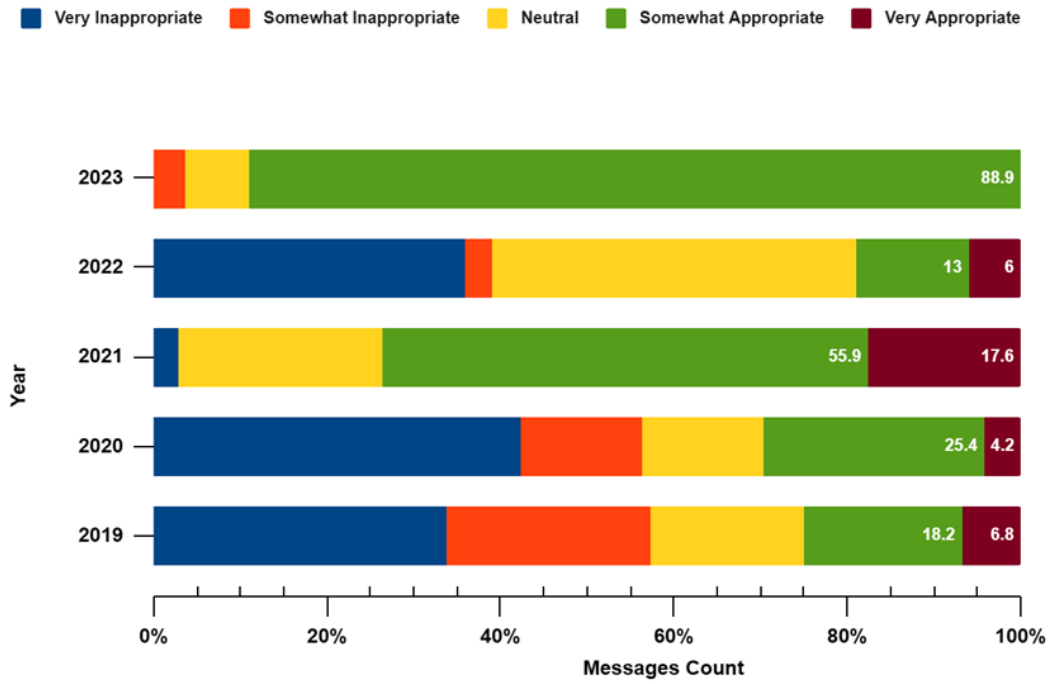


Figure 7: Career Expo Presentation at our Local Middle and Elementary Schools

Figure 8: Poster Presentation at an HBCU Student Research Symposium

Figure 9: International Conferences Poster Presentations

The visit by our students and faculty to a Majority Institution with nuclear facilities for nuclear manpower development and training is also pictorially captured as shown below. It was for five (5) days and captured learning and experiencing nuclear history of the USA, hydro electrical power generation and its utility, use of radionuclides, radiation safety training and use of robotics, and future internships.

Figure 10: Day One SUSTAIN Field Trip Activities

- After a long day of travelling, we arrived tired and excited. There was time to grab a quick meal and enjoy an impromptu visit to the Hoover Dam.
- The dam is massive and sits on two time zones, touching both Nevada and Arizona on each side. It is the largest wholesale water supplier and is the largest producer of hydropower in the Unites States. www.usbr.gov
- As we crossed the Memorial bridge, another patron recognized our school logo. She hugged the professors and wished us well remembering our school from the recent news.
- We also stopped at Hemenway Park, well known for where Desert Big Horn Sheep hang out! We did not see any sheep unfortunately.

Figure 11: Day Two SUSTAIN Field Trip Activities

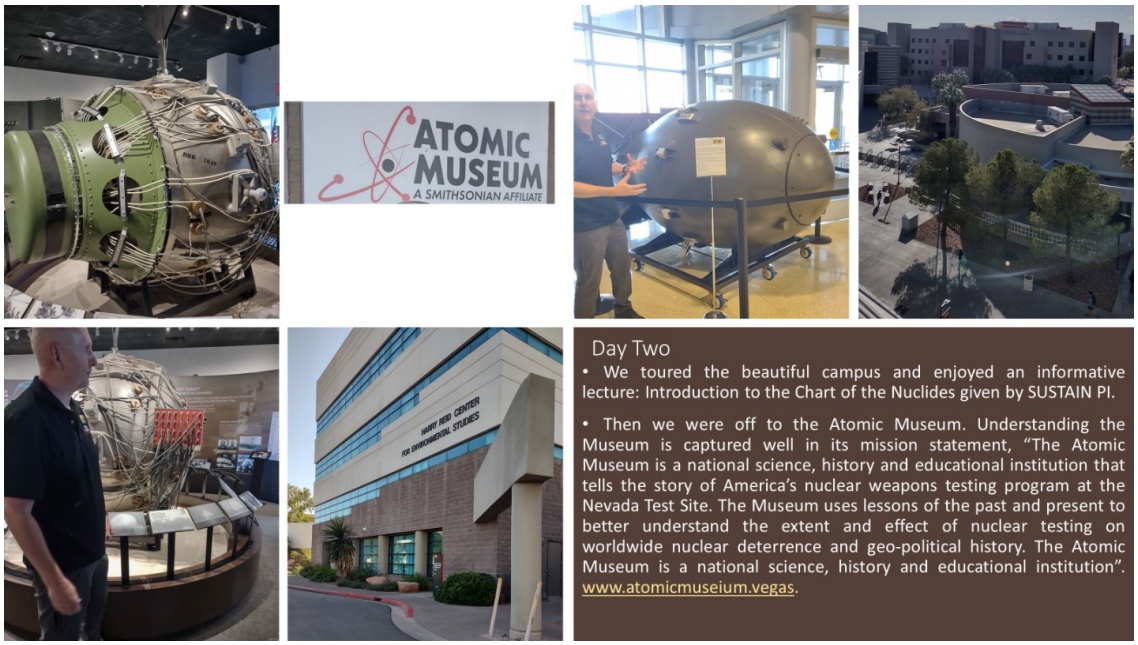


Figure 12: Day Three SUSTAIN Field Trip Activities

- Radiation Safety Training and Robotics
- Presentation: Prospectus Defense with Radiochemistry graduate studen
- Outdoor Aerial Drone and Ground Robot Demonstration

Figure 13: Day Four SUSTAIN Field Trip Activity

Figure 14: Day Four SUSTAIN Field Trip Activities

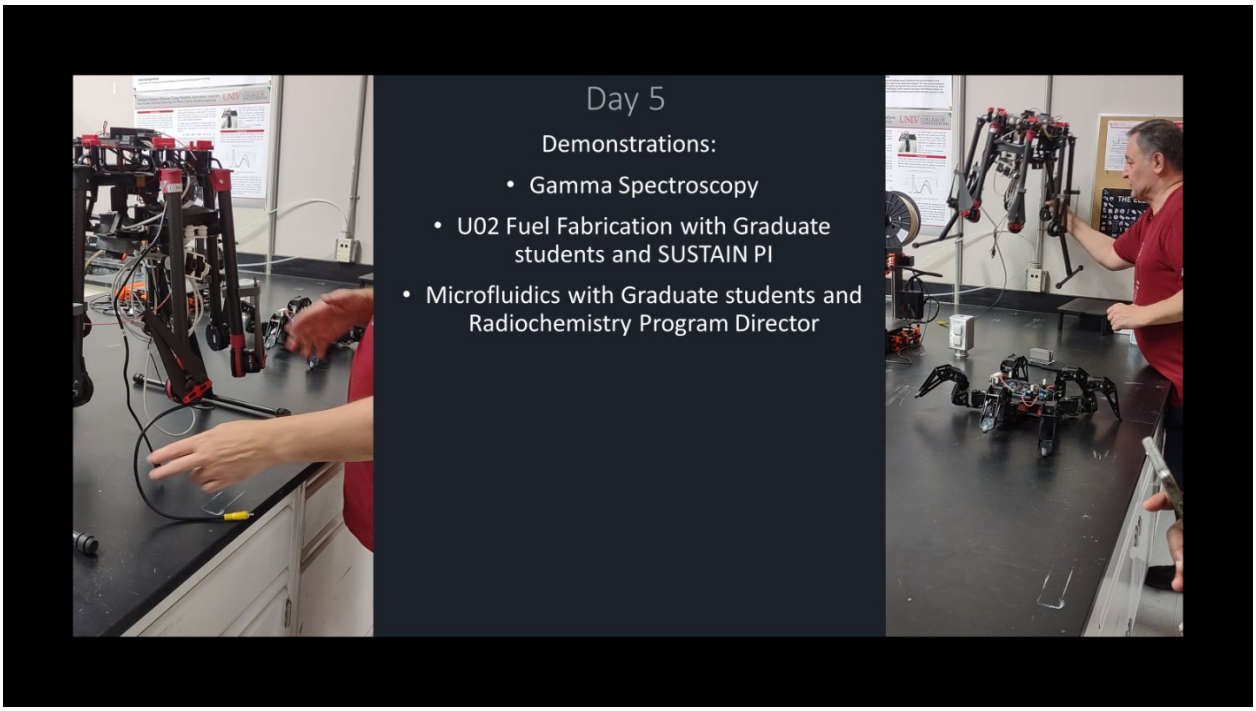
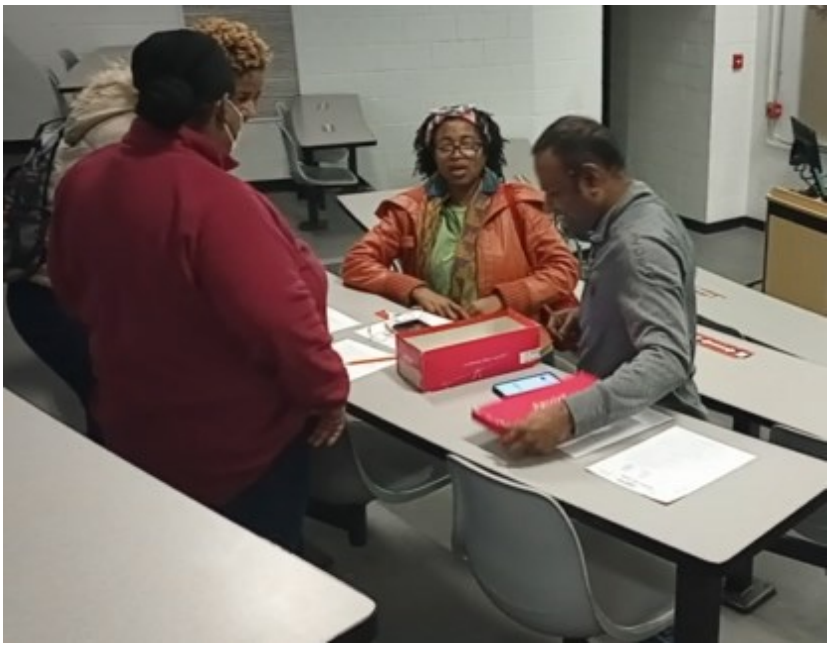


Figure 15: SUSTAIN Graduation Class of March 2024

Figure 16: SUSTAIN March 2024 Family Café at Radioactive Decay Curve Determination with Pennies



Activity Details and Recommendations

The goals, specific aims and program of activities are now shown in Tables 1 and Table 2 [3]. Specifically, the Weekend classes met on Saturdays for 2 or 3 hours of instruction for 5 weeks over the winter semester. The emphasis was on hands-on experiential learning in a fun and relaxing environment. We drew activities from the ANS 'Navigating Nuclear" curriculum as well as other related STEAM sites such as NASA and DOE. Students who successfully completed the classes were awarded certificates of completion (Fig. 16). Instructors for these classes came from our STEAM faculty at our campus plus our collaborating universities as well as the nuclear industry and our local K-12 teachers. As pertains to our college students, we had them participating in the outreach (Fig. 7), conferences (Figs. 8 & 9) and hoping for rigorous summer internships to be identified with the support of our Majority Institutions (Figs. 10 & 12). Request for more funding to extend this research activity to campus wide study forum of Canvas messaging by students and the institutionalization of Homefront Factor studies as part of MSU 2030 Strategic Transformation Plan s as to create a Center to undertake these studies for policy enactment and planning.

Assessment and Evaluation Plan

As shown in Table 1, the assessment and evaluation of our project is based on the outcomes. Our team is tasked with Task 4 that has four outcomes. Task 4 uses the insights from the other project tasks to inform content development [3]. Specifically, Task 4 begins with first, translation of insights from the gap analysis into a strategic plan for content development. The development of formal educational content and enrichment programs for K-12 schools, community colleges, trade-schools, undergraduate, and post-graduate programs is an expectation. This content includes courses, lectures, and hands-on opportunities over multiple technical levels. It is expected that this content will result in content that can be transitioned into actual educational opportunities that can be accredited or certified and used for workforce training and enhancement. The diverse experience of our project team will permit tu rning of the technical information to a range of levels.

Secondly, our task also creates content to facilitate the transition of experienced, skilled workers and tradespersons to the nuclear sector. This is expected to be an important consideration as the electrical generation section is expected to move from fossil fuel to non-CO_2 emitting power generation. The current fossil fuel workforce represents an opportunity (both for workers and the industry) as these workers may be able to transition to other energy sectors. Transitioning workers will need to understan d and appreciate fundamental concepts of nuclear technology and the overall culture of nuclear power generation and operations. To assure a robust future workforce pipeline, the development of general educational content to communicate the advantages of nuclear power and the possibility of a nuclear career is also an outcome within Task 4. Thirdly, our task is to include online modules, internships and practicums, and facilitated knowledge transfer sessions. Efforts are being made to set up a centralized clearinghouse. One possibility is to partner with Oak Ridge Institute for Science and Education (ORISE) and other existing programs in our Majority Institutions. The audience target for this effort will be wide, from families, K-12 to graduate level. For knowledge transfer, interactions with industrial partners are expected. The knowledge transfer includes job training, participation in outreach, mentorship, and documentation of experience from experts. This can include video documentation that can be incorporated into online media distribution and massive open online courses. It is therefore hoped that Task 4 plus our team activities [3] will provide a useful tool for evaluation by professionals, education programs and activities in our institutions and governmental bodies to help train the next group of nuclear engineers, scientists and technologists from our minority students in HBCUs. This is especially for those of us who aim to benefit and to improve the education delivery, nuclear data retrieval and analysis, digital information knowledge, effective institutional linkages that can enhance mutual research

and development of minority human resources to promote capacity building and our national security especially through economic success.

Conclusion

The issues discussed in this paper have found their way into our nation education and technological forums, industry, and policy think tanks. Our national academy of sciences, national councils for science and technology, industrial research and development institutes, institution of engineers among other professional bodies, non-governmental organizations (NGOs), community-based organizations continue reaching out through our various university programs and activities, many professional societies and the private sector. It is therefore hoped that our team activities will provide a useful resource to professionals, education programs and activities in our institutions and governmental bodies to help train the next group of nuclear engineers, scientists and technologists from our minority students in HBCUs. This is especially for those of us who aim to benefit and to improve the education delivery, nuclear data retrieval and analysis, digital information knowledge, effective institutional linkages that can enhance mutual research and development of minority human resources to promote capacity building and our national security especially through economic success. Our concerted efforts are still being challenged by some otherism [18] and contextual factors that continue to remind us to be humble, patient, persistent and to have faith in the resilience of our communities.

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Saturday Academy Registration Form

1. Our University *SUSTAIN (Supporting Strategic Training of Adaptable and Integrated Nuclear Workforce) WINTER 2024 FREE STEAM Saturday Academy Registration.*
2. *FEBRUARY 10, 2024 – MARCH 09, 2024*
3. *Tuition cost for the Saturday Academy is FREE; $20.00.*
   Non-Refundable Registration Fee by FEBRUARY 9, 2024, After FEBRUARY 09, 2024, registration will be $25.00.
4. *Classes meet from 9:00am – 12:00pm on Saturdays in the Science Complex on Cold Spring Lane*
5. ***NOTE**: If your child's grade is unavailable on the form that means that the class is full, and we will no longer be accepting students in that grade level for this session. However, you can fill out the form and click the waiting list box for the appropriate grade.*
6. ****PLEASE CLICK THE SUBMIT BUTTON AT THE BOTTOM OF THE FORM. YOU SHOULD SEE A CONFIRMATION MESSAGE AFTER THE FORM IS SUBMITTED.*
7. *TO FULLY REGISTER, YOU MUST COMPLETE THE REGISTRATION PAYMENT VIA EVENTBRITE: https://www.eventbrite.com/e/baltimore-murep-aerospace-academy-winter-stem-saturday-academy-2023-tickets-458550866987.*
8. *WITHOUT SUCCESSFUL COMPLETION OF THE PAYMENT, YOUR CHILD IS NOT FULLY ENROLLED.*
9. *THIS IS THE ONLY CONFIRMATION YOU WILL GET AND NOTE THE START DATE FOR THE SESSION.*
10. SESSION DATES
    i. *SESSION 1- FEBRUARY 10, 2024*
    ii. *SESSION 2 - FEBRUARY 17, 2024*
    iii. *SESSION 3 - FEBRUARY 24, 2024*
    iv. *SESSION 4 - MARCH 2, 2024*
    v. *SESSION 5 - MARCH 16, 2024*

Acknowledgments

We are very grateful to our Morgan State University (MSU) for their continued financial support and confidence with our team; our students who have continued to make us proud because of their resilience and tenacity; the teams from our Majority Institutions (University of Nevada, Las Vegas; University of Maryland, College Park) and private sector (NuScale, Power, LLC; Impact Allies, Inc. - Research and Evaluation) for their technical support and guidance. This work was previously supported by NSF under Grant No. 1915614; NASA under SaSa Grant No. NNH20ZDA001N-SciAct and is now funded by DOE under Grant No. 22-27567 and MSU Grant for Homefront Factor studies. The opinions, findings, and conclusions or recommendations expressed are those of the author(s) and do not necessarily reflect the views of our funding institutions.