Characterizing student needs for neuroscience educational programs at Augusta University

Vikash Ayyappan
Department of Neuroscience & Regenerative Medicine, Medical College of Georgia, Augusta University, Augusta, Georgia, USA 30912

Abstract

This study investigates the preferences, experiences, and career aspirations of undergraduate neuroscience students at Augusta University (AU), focusing on the Diversity Integrated Program in Neuroscience (DIP-IN). Aimed at addressing the gap between student expectations and the offerings of AU's neuroscience program, the research highlights disparities in access to educational opportunities for underrepresented groups, affecting both research and healthcare equity. Survey findings reveal that students prioritize flexible academic options available year-round and seek a curriculum integrating traditional neuroscience topics with practical skills and technological advancements. These results underline the need to refine DIP-IN to create a more inclusive, equitable, and effective learning environment. By aligning the program with student needs, AU's neuroscience program can address these gaps and better prepare MSTEM students for the evolving demands of the neuroscience field.

Abbreviations: AU – Augusta University, DIP-IN – Diversity Integrated Program in Neuroscience, MSTEM – Medicine, Science, Technology, Education, Mathematics

Keywords: Neuroscience, Inclusivity, Diversity, Undergraduate, MSTEM, Medicine

Introduction

The landscape of higher education, particularly in Medicine, Science, Technology, Engineering, and Mathematics (MSTEM), has undergone substantial transformation in recent years, driven by technological advancements, shifts in pedagogical methodologies, and the evolving demands of a competitive global workforce. These changes highlight the necessity for adaptive learning environments that equip students with skills relevant to their future careers (Meletiou-Mavrotheris, 2022). Augusta University (AU) reflects this dynamic shift, aiming to cultivate a diverse and inclusive educational framework that prepares students for success in MSTEM disciplines (Misra, 2022).

Understanding student perspectives and aspirations is pivotal for shaping effective educational programs. In neuroscience—a field defined by rapid scientific advancements—programs must align with student needs to remain effective. This study investigates undergraduate neuroscience education at AU, focusing on student experiences, preferences, and career goals to refine its programs and address gaps in educational offerings. Student insights not only help identify opportunities for improvement but also ensure programs remain inclusive and relevant (Ramirez, 2020).

At the center of this study is the Diversity Integrated Program in Neuroscience (DIP-IN), an initiative designed to foster inclusivity and diversity in neuroscience education. DIP-IN stands out by incorporating student feedback into curriculum development, addressing barriers faced by underrepresented racial, ethnic, and socioeconomic groups. Unlike other diversity initiatives that emphasize representation alone, DIP-IN integrates mentorship, community engagement, and hands-on research to create an equitable learning environment (La Scala et al., 2023). Similar programs exist nationwide; however, DIP-IN's focus on a holistic approach sets it apart, offering a model for how educational institutions can dismantle systemic inequities (Maldonado-Vlaar, n.d.).

Barriers to participation in neuroscience education remain significant, particularly for underrepresented groups. Systemic inequities exacerbate healthcare disparities and limit diversity in scientific inquiry, especially in conditions such as Alzheimer's, Parkinson's, and stroke, which disproportionately affect certain populations (Barnes, 2014). Programs like DIP-IN are essential for bridging these gaps, offering students the resources and support needed to succeed while addressing broader inequities in the field.

By exploring student preferences and evaluating the effectiveness of programs like DIP-IN, this study contributes to the development of neuroscience education at AU and beyond. It provides actionable insights into how institutions can create inclusive, impactful programs that prepare students for both advanced study and meaningful careers in neuroscience.

This project seeks to provide actionable insights into the development of neuroscience programs at AU by exploring the preferences and educational aspirations of MSTEM students. Through an analysis of student perspectives, the research identifies strengths and areas for improvement within AU's academic offerings, with a particular focus on refining the DIP-IN to better meet student needs.

The findings aim to contribute to the advancement of inclusive undergraduate educational programs that prepare students for future careers in neuroscience, a field encompassing brain research, cognition, emotions, and computational sciences. By aligning neuroscience programs with student expectations, this initiative supports AU's broader goal of fostering diversity and innovation in MSTEM disciplines.

Understanding students' perspectives on learning, personal development, and career goals is pivotal for designing programs that enhance educational outcomes. These insights inform the creation of inclusive and adaptive curricula, increasing the likelihood of students thriving in MSTEM careers and making meaningful contributions to the field. Ultimately, this project advances not only neuroscience education but also broader efforts to address systemic inequities in the medical and scientific community.

Materials and Methods

The survey process commenced by requesting students to complete a consent form, wherein they provide pertinent personal information. If a student opts not to agree with the consent form, the survey will promptly notify them that their participation has concluded. Upon agreeing to the consent form, students are obligated to provide the following information: their voluntary consent, their self-identification with a specific gender, disclosure of Hispanic or Latino ethnicity, accurate reporting of their race/ethnicity, and confirmation regarding the presence of any current disabilities or disadvantaged backgrounds. Following the initial information collection, the survey proceeded to request the student's high school details, including their Grade Point Average (GPA) and

any Advanced Placement (AP) courses taken previously. Additionally, students were asked to provide information about their current university enrollment, their academic year, their declared major of study, and whether they are enrolled in a specialized academic program such as BS/MD, BS/DMD, or the Honors Program. Subsequently, the survey will guide students to complete a table detailing the number of courses they have taken in various disciplines, including Biology, Chemistry, Computing/IT/Cyber Sciences, Psychology, Nursing, Mathematics, and Kinesiology. Additionally, participants were asked to indicate their preference regarding the program's scheduling, choosing from options such as offering it exclusively during the academic year, exclusively in the summer semester, or during both the academic year and summer semester. In the final section of the survey, participants were asked to assess the importance of various topics on a scale ranging from least important to extremely important, should they have the opportunity to further their knowledge in these areas. The topics for evaluation include Grant Writing, MATLAB, Whole Brain Imaging, Stereotaxic Surgeries and *In Vivo* Techniques, Microscopy, Neuroanatomy, Weekly Foundational Overview Lectures from participating faculty, Research Design, Scientific Writing, Computer Programming, 'Big Data' methods, Emerging Laboratory Techniques in Neuroscience, Future Trends in Brain/Mind Research, Artificial Intelligence (Brain Machine Interface), and Applications of Neuroscience in Medicine, Technology, and Society at Large. Furthermore, respondents had the opportunity to provide an open-ended response, indicating any additional skills they might be interested in learning about.

The survey concluded by expressing gratitude to the students for their valuable time and efforts in participating. All collected data were transferred from Qualtrics to a Microsoft Excel spreadsheet to facilitate comprehensive analysis and draw conclusions. The converted digital data, exported from Qualtrics, was securely transferred to a Microsoft Excel spreadsheet stored on a PC linked to a protected R drive server. It is imperative to note that any incomplete surveys were excluded from subsequent analyses, ensuring the integrity and accuracy of the research findings.

Procedure

A survey was designed to gather data from undergraduate students at AU. The questionnaire was finalized in mid-January and submitted to the Institutional Review Board (IRB) for approval. Following IRB approval in April, the data collection phase commenced.

Invitational emails, incorporating web consent forms, were distributed to students in the Honors Program and those enrolled in Biology and Psychology courses. The survey began with a consent statement to ensure ethical compliance. A total of 111 unique responses were collected, providing a robust dataset for analysis.The participants in this study consisted of undergraduate students enrolled at Augusta University. The data was gathered through a planned questionnaire conducted between April 2023 and September 2023.

The aim of this study was to survey at least 100 students. Each participant was limited to completing the survey once to maintain research integrity. Participants were directed to a Qualtrics survey platform through an invitation in their emails. The study received IRB approval, and informed consent was obtained from participants. All student responses were collected anonymously. Any participant who answered “yes” to the consent form would be guided to the study’s questionnaire and their data would be recorded. Any participant who answered “no” to the consent form was excluded from the study immediately. The surveyed population was a random sample of Augusta University students.

Results

The results obtained from the Qualtrics Survey conducted among AU students have provided valuable insights into the preferences and perspectives of MSTEM students within the university community. This study was conducted with the aim of shedding light on the educational aspirations of these students and understanding their preferences, with the ultimate goal of contributing to the development of neuroscience programs and enhancing the overall educational experience at AU.

Participant Characteristics

The survey yielded responses from 111 participants which consisted of 76 female participants, 32 male participants, and three participants identifying as other genders,

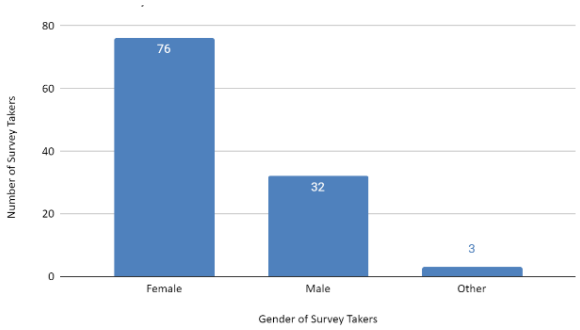

Figure 1. Gender distribution in survey takers. This bar plot graph shows the different self-reported genders of the respondents (*N*=111). The bar labeled "Other" (far right) refers to survey takers who do not categorize themselves as an option provided in the survey. See text for more details.

showcasing a diverse representation of gender among the respondents.

In terms of racial and ethnic diversity, the survey included 35 Asian, 41 White, 27 Black or African American, three Hispanic or Latino, and two Native Hawaiian or other Pacific Islander respondents. Additionally, 108 participants identified as not Hispanic/Latino, while three participants identified as Hispanic/Latino.

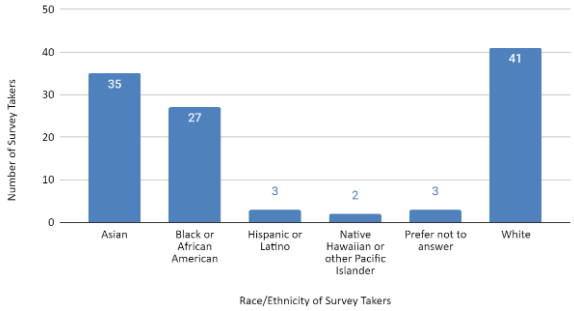

Figure 2. Race/Ethnicity distribution in survey takers. This bar plot graph shows the different self-reported race/ethnicity of the respondents (*N*=111). The bar labeled "Prefer not to answer" refers to survey takers who did not want to disclose their personal information. See text for more details.

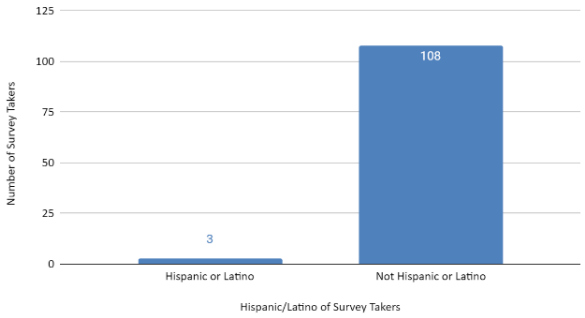

Figure 3. Hispanic/Latino distribution in survey takers. This bar plot graph shows the different self-reported classification of Hispanic/Latino in respondents (*N*=111). See text for more details.

Among the respondents, 94 students reported not coming from disadvantaged backgrounds, 11 students reported coming from disadvantaged backgrounds, and six chose not to disclose this information. While this demographic data highlights the inclusivity of the survey, further analysis is needed to understand the representation's impact on educational outcomes, as prior research suggests that diversity in student populations can enhance the academic experience by fostering diverse perspectives (Gottfredson et. al, 2008).

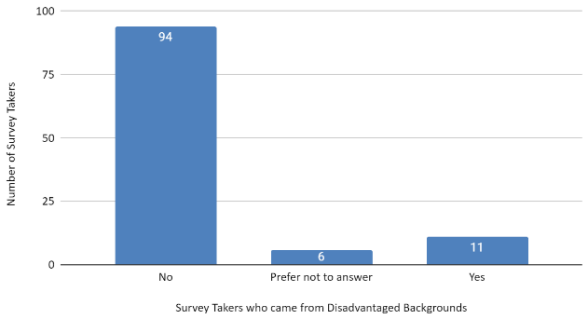

Figure 4. Survey Takers who came from Self-Reported Disadvantaged Backgrounds. This bar plot graph shows the self-reported respondent responses (*N*=111) on whether they came from a disadvantaged background. The bar labeled "Prefer not to answer" refers to respondents who did not want to disclose their personal information. See text for more details.

The survey further provided insights into the academic backgrounds of the participants. Among the respondents, 16 were Freshmen, 43 were Sophomores, 20 were Juniors, and 28 were Seniors, with four participants falling into the category of "Other." The survey encompassed a variety of students in different majors. The top three majors consisted of 31 Psychology Students, 20 Cellular and Molecular Biology Students, and 16 Biology Students. With that, 59 participants were enrolled in the Honors Program, 36 followed the Normal Pathway, four were on the BS/MD track, and 12 fell into the "Other" category regarding their chosen academic pathways. The prominence of these majors reflects trends observed in neuroscience education programs, where interdisciplinary interest plays a key role in attracting students (Wiertelak, 2008).

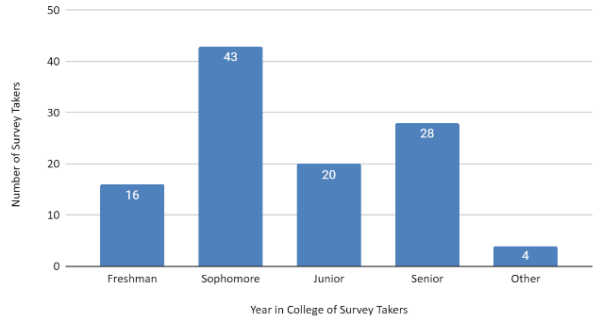

Figure 5. Year in college distribution in survey takers. This bar plot graph shows the different self-reported college year classifications of the respondents (*N*=111). The bar labeled "Other" (far right) refers to respondents who do not categorize themselves as an option provided in the survey. See text for more details.

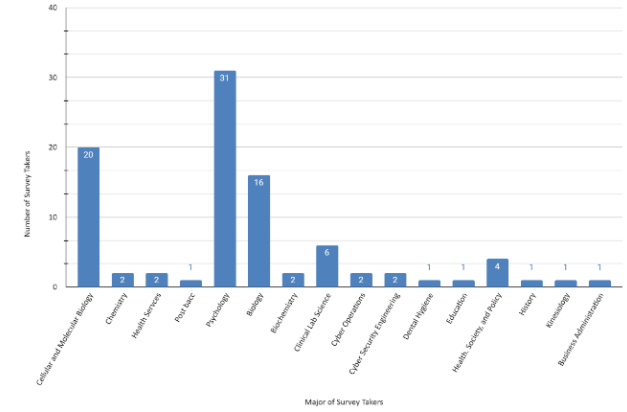

Figure 6. The distribution of different college majors in survey respondents. This bar plot graph shows the different self-reported post-secondary majors of the respondents (*N*=111).

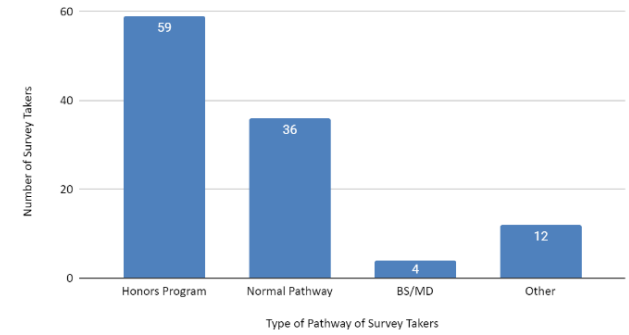

Figure 7. Distribution of unique college pathways in survey takers. This bar plot graph shows the different self-reported college pathways of respondents (*N*=111). The bar labeled "Other" (far right) refers to survey takers who do not categorize themselves as an option provided in the survey. See text for more details.

Participant Perceptions

The survey data revealed distinct trends in students' enrollment in various course subjects. A majority of respondents had not taken courses in Nursing (106 students), Kinesiology (104

students), and Computing/Cyber Sciences (99 students), indicating limited engagement in these fields. Conversely, Biology and Chemistry showed higher levels of participation, with 39 and 26 students, respectively, having taken two courses in these subjects. Additionally, 23 students reported taking four or more Psychology courses, highlighting strong interest in this area. These findings align with prior research suggesting that students tend to concentrate coursework in fields relevant to their career goals.

Table 1. Number of courses students have taken and/or are currently taking

Course	0 Courses	1 Course	2 Courses	3 Courses	4+ Courses	Total
Biology	15	25	39	11	21	111
Chemistry	22	36	26	19	8	111
Computing/Cyber Sciences	99	7	0	2	3	111
Psychology	29	42	14	3	23	111
Nursing	106	3	1	0	1	111
Mathematics & Statictics	10	23	47	20	11	111
Kinesiology	104	4	2	0	1	111

This data table shows the number of courses students have/are taking in college based on self-reported data of respondents (*N*=111). The columns and rows display the number of courses respondents have taken for each course type, respectively. All rows add to a total of 111 respondents. See text for more details.

The survey data revealed significant patterns in students' preferences for the timing of academic programs. A notable portion of the participants, 47 students, indicated a likelihood of participating in academic year programs, with 33 students expressing extreme likelihood. Summer terms also garnered substantial interest, with 40 students expressing a likelihood of participation and 16 students indicating extreme likelihood. Moreover, a considerable majority of students, 53 participants, expressed an extreme likelihood of participating in programs offered both during the academic year and summer terms. This aligns with findings from studies that suggest flexible scheduling can increase program enrollment (Radovan, 2024).

Table 2. When students are likely to take Neuro-Program based on offering timings.

Offered	Extremely Unlikely	Somewhat Unlikely	Neither likely nor unlikely	Somewhat likely	Extremely Likely
Academic Year Only	2	6	23	47	33
Summer Terms Only	17	20	18	40	16
Both academic & summer	3	7	14	34	53

This data table shows the best time students are likely to take neuro-program content based on different offering options based on self-reported data of respondents (*N*=111). The columns and rows display the likelihood of respondents based on the course timings., respectively. All rows add to a total of 111 respondents. See text for details.

Table 3. How important students feel if they find an opportunity to learn different neuro-program topics.

Topic	Not at all important	Slightly important	Moderately important	Very important	Extremely important
Grant Writing	8	17	46	28	12
MATLAB	15	20	46	21	9
Whole Brain Imaging	5	13	18	41	34
Stereotaxic Surgeries and In Vivo Techniques	14	13	27	20	37
Microscopy	6	9	31	37	28
Neuroanatomy	4	9	17	33	48
Weekly Foundational	10	13	35	29	24
Research Design	4	5	20	40	42
Scientific Writing	0	2	35	30	44
Computer Programming	10	25	36	20	20
“Big Data” Methods	4	18	38	38	13
Emerging Laboratory	3	12	21	29	46
Future Trends in Brain/Mind Research	3	13	12	34	49
Artificial Intelligence, Brain-Machine Interface	5	15	24	30	37
Applications of Neuroscience in Medicine, Technology, and Society at Large	2	10	19	29	51

This data table shows how important respondents feel about different neuro-program course topics based on self-reported data of respondents (*N*=111). The columns and rows displays the importance of respondents based on the unique topics, respectively. All rows add to a total of 111 respondents. See text for details.

Discussion

Demographics

Analyzing the course distribution illuminates the strengths of AU's current academic offerings. The robust interest in Biology, Chemistry, and Psychology programs indicates the university's success in providing appealing and engaging courses within these disciplines. Additionally, the high enrollment in Nursing highlights the effectiveness of AU's nursing program.

Nevertheless, the data also reveals potential shortcomings. Even though the survey was sent to a wide variety of students in different science fields and various majors through the Honors Program, individual student participation was voluntary, individually, to contribute to the study's growth on MSTEM education. That being said, the limited interest in Computing/Cyber Sciences courses, despite their growing significance in the digital age, suggests a need for curriculum enhancement or increased awareness about the opportunities these courses offer in relation to neuroscience programs for students interested in covering both topics. These might include expanding awareness campaigns about the benefits of Computing/Cyber Sciences courses, revising the curriculum to offer more advanced coursework, and providing additional support to students interested in pursuing these subjects. Addressing these gaps can enhance the overall academic experience for AU students.

The survey findings hold significant implications for AU's neuroscience programs and academic experiences for MSTEM students. The study reveals a wide range of gender representation, emphasizing the program's inclusivity. Additionally, the survey highlights a greater significance of an inclusive environment for students from diverse ethnic, racial, and socioeconomic backgrounds based on the participants' self-reported data. "Furthermore, the survey demonstrates a widespread interest in neuroscience across different academic years and majors, emphasizing the interdisciplinary nature of the field. Lastly, insights into the pathways through which students enter neuroscience programs offer valuable information for program administrators, suggesting the need for tailored resources and support to enhance student's academic experiences and success.

Preferences for Academic Terms

Students' preferences for neuroscience programs at AU have important implications. There is high interest in academic year programs which emphasize the need for engaging coursework aligned with students' calendars. Designing programs tailored to academic schedules can boost participation. Additionally, interest in year-round programs offers a chance for AU to expand offerings. Intensive, specialized summer programs can enhance students' skills in specific neuroscience areas as well as during the academic year. The trend of having more support in academic year courses than summer courses likely fall on the perception of difficulty in science courses. To address diverse needs, AU should adopt a flexible approach, offering varied program options and support. This customization ensures alignment with students' preferences, enhancing their educational experience.

Importance of Specific Topics

The results from the Qualtrics Survey provide significant insights into the preferences and priorities of MSTEM students at Augusta University concerning various topics within neuroscience education. Understanding these preferences is pivotal for shaping effective educational programs and ensuring that they align with the aspirations of the students. The findings from Table 3, which presents the importance students place on different topics, reveal patterns and trends that are crucial for the development and refinement of neuroscience programs. This

reflects a growing trend among neuroscience students who prioritize interdisciplinary learning and real-world applications (Hackett et. al, 2018). Skills such as scientific writing, research design, and grant writing also emerged as critical areas of interest, aligning with the emphasis on practical skill development seen in modern neuroscience programs (Wiertelak, 2008).

Neuroscience students at Augusta University exhibit a diverse range of interests, as evidenced by their varying levels of importance assigned to different topics. Notably, topics such as "Applications of Neuroscience in Medicine, Technology, and Society at Large," "Future Trends in Brain/Mind Research," and "Neuroanatomy" are highly valued, with a significant proportion of students considering them very important or extremely important. This suggests a keen interest among students in exploring the interdisciplinary aspects of neuroscience and its real-world applications.

The survey results underscore the practical orientation of students, with a significant focus on skills such as "Scientific Writing," "Research Design," and "Grant Writing." These findings underscore the need of fostering strong communication, experimental design, and grant application skills among neuroscience students. The high ratings for "Computer Programming," "MATLAB," and "Big Data Methods" also reflect the contemporary emphasis on computational and data analysis skills in neuroscience research. The emphasis on topics related to emerging technologies, such as "Artificial Intelligence, Brain-Machine Interface," and "Whole Brain Imaging," indicates students' recognition of the evolving nature of neuroscience research.

These findings offer valuable implications for the development of neuroscience programs at Augusta University. The data suggests a need for a well-rounded curriculum that combines traditional neuroscientific knowledge with practical skills and exposure to cutting-edge technologies. Furthermore, there is an opportunity to enhance the curriculum by integrating interdisciplinary perspectives, emphasizing real-world applications, and providing ample opportunities for students to develop critical skills like scientific writing and research design.

Concluding Remarks

The analysis of the Qualtrics Survey conducted among AU students provides important insights into the preferences and perspectives of MSTEM students within the university community. The participants represented a diverse range of gender, race, and academic backgrounds, which reflects the inclusive nature of AU's student body. The findings highlight the strengths of AU's academic offerings in Biology, Chemistry, and Psychology, while also pointing out areas for improvement, particularly in Computing/Cyber Sciences courses in relation to MSTEM education.

The survey results offer valuable guidance for enhancing AU's neuroscience programs and the overall educational experience of MSTEM students. The balanced gender representation and widespread interest in neuroscience across different academic years and majors underscore the interdisciplinary appeal of the field. This demonstrates the need for tailored resources and support to elevate students' academic experiences and success. Additionally, the survey underscores the importance of specific topics in neuroscience, such as applications in medicine, technology, and society, as well as emerging technologies like artificial intelligence and brain-machine interfaces. These insights emphasize the necessity of a curriculum that integrates traditional neuroscientific knowledge with practical skills and exposure to cutting-edge technologies. Additionally, students' preferences for the timing of academic programs, both during the academic year and summer terms, suggest the need for flexible program options that align with

students' schedules and enhance their educational experience. AU can benefit from this interest by designing engaging coursework and specialized summer programs that cater to diverse student needs.

To address the identified gaps and leverage the strengths revealed by the survey, AU should consider targeted interventions. These interventions may include raising awareness about the benefits of Computing/Cyber Sciences courses, revising the curriculum to offer more advanced coursework, and providing additional support to students interested in these subjects. Additionally, AU can enhance the neuroscience curriculum by integrating interdisciplinary perspectives, emphasizing real-world applications, and providing opportunities for students to develop critical skills such as scientific writing and research design.

In summary, the findings of this study provide a valuable foundation for AU to refine its neuroscience programs and enhance the overall educational experience for MSTEM students. By addressing the identified gaps and leveraging the strengths revealed by the survey, AU can create an inclusive learning environment that prepares students for success in the rapidly evolving field of neuroscience and equips them with the skills and knowledge needed to contribute meaningfully to society.

Conflict of Interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Corresponding Author

Vikash Ayyappan
Augusta University
vayyappan@augusta.edu
943 Rollo Domino Cir, Evans, GA 30809

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