Journal of Education and Human Development
December 2021, Vol. 10, No. 4, pp. 1-13
ISSN: 2334-296X (Print), 2334-2978 (Online)

Published by American Research Institute for Policy Development
DOI: 10.15640/jehd.v10n4a1
URL: https://doi.org/10.15640/jehd.v10n4a1

A Phenomenological Study of Factors that Enhance Louis Stokes Mississippi Alliance for Minority Participation (Lsmamp) Students' Persistence and Degree Attainment in Stem

Felix A. Okojie[1]*, Martha Tchounwou[2], and Dickson Idusuyi[3]

Abstract

The purpose of this study was to address best practices capable of bridging the retention and completion gaps in STEM education for underrepresentedminority students. Using a phenomenologicaldesign, this article delineates Louis Stokes Mississippi Alliance for Minority Participation (LSMAMP) program experiences, instructional strategies, institutional practices and students' persistence within the LSMAMP community. Five main themes emerged from the student interviews and survey results: (1) early exposure to STEM and familial support; (2) hands on involvement and academic intervention activities; (3) Peer group support; (4) institutional environment and infrastructural support; and (5) financial incentives. The top choices of faculty and site coordinators about institutional and instructional practices and learning strategies that enhance student learning and degree attainment were faculty mentoring, student opportunities to present research at or attend professional conferences, peer tutoring, and student opportunities to connect prior learning to new lecture content.

Keywords: STEM, best practices, LSMAMP student, persistence, academic success.

"This research is based upon work supported by the National Science Foundation, LSMAMP Award Number 1826699. Any opinions, findings, and conclusions or recommendations expressed in the research are those of the authors and do not necessarily reflect the views of the National Science Foundation."

Introduction

For the United States to maintain its global competitiveness in science and engineering, there is a continuous need to develop and engage its diverse human capital (Lane, 2016; NSF, 2014) A growing body of research shows disparities between students in STEM fields across several demographic variables; race, gender, and socio-economic background (Riegle-Crumb, 2010, Eagon et al; 2015; Griffith; 2010). Presently, under-represented minority students are the fastest growing segment across the nation, yet are the least represented in STEM fields (Institute of Medicine, 2011; Toven-Lindsey et al; 2015)

On most institutions of higher education campuses, the persistence and graduation rates of underrepresented minorities (URM) and first-generation students lag behind those of their majority counterparts (Elrod & Kezar, 2015). In a quantitative study conducted by Whalen and Shelley (2010), their analysis revealed that students who are male and non-minority in STEM majors are about 74.6% more likely to be retained and graduate than female or minority STEM students. As a result, there is a growing emphasis on the need to develop sustainable institution-wide models that highlight high impact practices that dramatically improve the graduation rates of URM students in STEM fields (Kuh & O'Donnell, 2013). The Steering Committee for Evaluating Instructional Scholarship for Engineering (2009) is requiring institutions to collect evidence demonstrating their success in undergraduate instruction. Moreover, if the U.S. is to achieve equity among URMs in STEM fields, it is imperative to expose the education literature that addresses effective STEM experiences and teaching methodologies that create the most conducive learning environment capable of bridging the completion gap in STEM education among URM (Espinosa, 2011).

[1] Executive PhD Program in Urban Higher Education, Jackson State University, Jackson, MS 39204
[2] College of Science, Engineering and Technology, Jackson State University, Jackson, MS 39217
[3] Alcorn State University, Lorman, MS 39096

Through funding from Louis Stokes Mississippi Alliance for Minority Participation(LSMAMP), Mississippi's higher education institutions have accomplished laudable strides in ensuring the success of minority students majoring in STEM disciplines. Even though the academic profile for minority students majoring in the STEM field reflect low persistence, participation, and performance (Griffith, 2010), graduation percentages have increased significantly among all nine LSMAMP Mississippi institutions. In the last five years, Mississippi's LSMAMP Alliance reports graduation percentages across it's institutions with an increase of 96%, for the University of Mississippi, 88.4% for University of Southern Mississippi, 82.4% for Delta State University, 91.4% at Mississippi State University, 88.6% at Jackson State University, 72% at Alcorn State University, 52.2% at Mississippi Valley State University, and 48% at Tougaloo College. Most impressively, the number of under-represented minorities who earned doctorates in STEM disciplines at the Mississippi Alliance has an increase of 46.8% from 2015 to 2019 (LSMAMP Database, 2020).

Despite decades of success among the Alliance, continued improvement to enhance success across institutions is warranted, specifically in sciences and engineering fields. From a national perspective, African Americans and Latinos remain underrepresented in all areas of natural sciences and engineering (NSF, 2013). Among the two minority groups, African Americans are disproportionately impacted indicating a decline in bachelor's degree production in physics and engineering from years 2001-2010 in comparison to an incline in bachelor's degrees earned in both physics and engineering fields among Latino students (NSF, 2013). Currently, the Alliance reports variation in persistence and graduation rates across LSAMP institutions in the sciences and engineering disciplines. For example, Jackson State University, a Historically Black College and University (HBCU), has maintained an upward trend in producing science and engineering degrees among LSMAMP students while other HBCUs within the Alliance struggle to achieve the same success. According to NSF (2013) data, HBCUs were the only institution type to show an upward trend in institutional yield ratio among minority Black science and engineering doctorates (NSF, 2013). Many researchers assert that increased minority graduation rates in STEM programs are linked to the cultural connections that minority students experience when attending a minority serving institutions (McGlynn, 2007; Riley, 2015). However, when HBCUs within the Alliance fail to maintain similar science and engineering degree production trends, one must question this notion. Moreover, the University of Mississippi, a Predominately White Institution (PWI) within the Alliance has maintained continuous improvement in degree production among LSMAMP students while other PWIs within the Alliance have struggled to keep pace. Given this variation among institutions and to continue the momentum of the Alliance, it is important to examine student persistence and success across institutions. Through this study, the research questions seek to identify and describe best practices for students' persistence, academic success among the LSMAMP community.

Theoretical Framework / Literature Review

The theoretical foundation for this study is the integration of Kolb's Theory of Experiential Learning and the Diffusions of Innovations Theory. Kolb (1984) described learning as a "process whereby knowledge is created through the transformation of experiences" (p. 41). The Experiential Learning Theory (ELT) explains how the experiences of the learner might be able to predict the importance of influential factors in the learners' ascension into STEM disciplines (Wells & Grabert, 2004). ELT learning is student centered, requiring the learner to insert themselves in the learning experience putting theory into practice by creating a clear understanding or "particular order of practice" (Tennant & Pogson, 2005 p. 155).

No less important, is knowledge that uncovers the effectiveness of the channel of communication when adopting new academic innovations that enhance STEM success. The Diffusion of Innovations Theory, developed by Everett Rogers in 1963 examines the social process that occurs when new innovations, or new ideas are diffused throughout a community, organization, or institution. An innovation is an idea, practice, or object perceived as new by an individual or other unit of adoption (Rogers, 1981, p. 35). Diffusion is explained by Rogers as a process by which an innovation is communicated through certain channels over time among the members of a social system. According to Rogers (1981), this form of communication is more effective when individuals "share common meanings, a mutual subcultural language, and are alike in personal and social characteristics; the communication of ideas is likely to have greater effects in terms of knowledge gain, attitude formation in change, and overt behavior change" (p.19).

Instructional activities and experiences that enhance the success of the LSMAMP Alliance have a distinct focus on increasing the social capital of the LSMAMP learning community. A learning community is a group of students who share common values and beliefs and are actively engaged in learning from each other (Learning & Ebbers, 1999). The LSMAMP Alliance fits this pedagogical model as it is designed for targeted groups, such as underrepresented minorities and students with similar academic interest (Learning & Ebbers, 1999).

Literature reveals that minorities, specifically enrolled in engineering fields, rely on social capital found in these learning communities for academic success. According to Riley (2015), a pathway to STEM careers and success in engineering fields is achieved through faculty-student interpersonal interactions that focus on adapting to the diverse learning and advising needs of the minority STEM student. The Alliance has created strong pipeline programs that enhance and support minority STEM student success. For example, the Alliance's summer bridge programs expose a cohort of high school graduates to precollege STEM experiences early in their academic career, thereby utilizing the social bonds of a cohort to enhance academic preparation and heighten STEM interest. Additionally, the Scholar's Academy utilized evidence-based retention strategies to include professional development through research opportunities and peer-led tutoring which improves students' critical thinking skills in mathematics, chemistry, and other sciences (Cracolice & Deming, 2001; Quitadamo, Brahler, & Crouch, 2009). Moreover, learning communities build on the development of innovative teaching approaches which Borrego and Henderson (2014) contend, "produces students who are more innovative, flexible and team oriented and able to navigate complexity and ambiguity" (p. 244). It is obvious that improving social capital has influenced the success of the AlliancePrograms, but less is understood about the successful ways in which these students are taught and how they experience STEM instruction which directly influences what they learn and the degree to which they persist (Bybee, 2006). Moreover, there is nationally recognized need to reform and improve how math and science are taught in the United States on both the precollege and postsecondary level (NAS, 2011).

Literature reveals that low participation and performance in science, technology, engineering, and mathematics has become an increasingly serious issue for African American and Hispanic students (Griffith, 2010). Many researchers have found that pedagogy, persistence, and institution wide reform are critical factors in improving minority success in STEM disciplines. Lee and Harmon (2013) believed that institution-wide efforts that combine specific academic, social, and research support interventions have resulted in significant improvements in graduation of minority STEM students. Research on STEM postsecondary minority attrition indicates that faculty mentoring, research opportunities, and scholarship support are critical elements in keeping minority STEM students retained in the postsecondary pipeline (Golde, 2005; Depass & Chubin, 2008). Unclearin the literature are the ways in which these high impact practices reform STEM pedagogy and influence persistence and retention among minority STEM students. Addis, Quardokus, Bassham, Becraft, and Boury (2013) believed that increased enrollment and retention in STEM fields requires "top down" change that "occurs when the formal structures of the university and departments are modified to use the skills and knowledge developed in the learning community to guide reform" (p. 24). While understanding how to implement high-impact practices on an institutional and student level may be difficult, it is imperative that institutions recognize that this specialized function is significant to minority STEM student success and has shown evidence in significantly improving the graduation rates of underrepresented minority students (Kuh & O'Donnell, 2013).

In view of critical intervention points, the President's Council of Advisors on Science and Technology (PCAST) believes there should be a strong focus on the quality of STEM education in the first two years of college to include research on students' choices, STEM learning processes, and STEM preparation (BHEF, 2013). Additional evidence-based retention strategies documented in the literature directs attention to the connection between STEM students' success and precollege preparation (Adelman, 2006; Anderson & Kim, 2006; NCES, 2009). Precollege STEM preparation consists of programs and instructional experiences that give students the opportunity to engage in the inquiry process, plan and carry out independent investigations, and seek evidence for their argument (NAS, 2011). Acquiring these skills is highly recommended for undergraduate STEM success. However, access to higher order thinking curricula is resource rich and usually reserved for wealthier students (Gorski, 2009). This might explain why many minority STEM students change their STEM major to less demanding majors or drop out of college altogether after their first or second year (Adelman, 2006). Although literature points to precollege preparation as a significant factor that enhances STEM success, data reveal that many students who abandon STEM majors actually perform well in their introductory courses (BHEF, 2013). To perform well, yet abandon a program, is seemingly contradictory. Hence, it is important to consider the relationship between the students' perception of progress and the methods in which STEM instruction is taught and the diverse learning needs of the minority STEM student. Currently, there is scant literature that explains why students who engage in precollege STEM experiences still do not receive the knowledge, skills, and content needed to persist beyond introductory courses (Anderson, 2003; Owens, 2009)

Several researchers have examined pedagogical methods that assist STEM instructors with creating instructional environments that help their students acquire the knowledge and skills needed for STEM persistence and success. In view of minorities, Gay (2000) believed that culturally based pedagogy that addresses economics, race, and gender, captivates the imagination, making instruction relatable and motivating to minority students.

A National Science Foundation career study seeking to understand learning environments that create engineering pipelines, sought the perception and experiences of 1,400 first-generation undergraduate engineering students. Findings indicate a distinct need to create resource rich environments that adapt to the diverse needs of the minority student by focusing on advising, addressing student learning needs, and building faculty-student relationships (Riley, 2015). Additionally, there is a consensus regarding the success of interactive learning methods in STEM programs to include experiential instruction, peer-based mentoring, and collaborative instruction, noting that science is best learned by doing (Bybee, 2006; Owens, 2009). While it is acknowledged that instructional reform is imperative and precollege experiences and institutional support is critical to minority STEM success, there is still no sound method for determining STEM program effectiveness (Donnelly, 2008) nor the particular powerful combinations of different strategies that enhance minority STEM student success (Borrego & Henderson, 2014).

Higher education institutions cannot escape the reality that "our nation's universities are not producing graduates in STEM fields in numbers adequate to meet workforce demand" (BHF, 2013 p. 6). More specifically, dismal participation and performance in science and engineering has become an increasingly severe issue for African American and Hispanic students (Griffith, 2010; NSF, 2013). The synthesis of literature regarding the success of minority STEM students in this study is set in the context of understanding the various academic experiences, instructional strategies, and institutional practices that has shown evidence of supporting minority student success in STEM programs. Based on the literature, there is an obvious need for research that examines instructional methods, institutional practices, and precollege experiences that consistently and specifically demonstrate success among minority STEM students across institutional types and throughout science and engineering fields. It is expected that findings will answer the call to understand the knowledge, skills, and content needed to assist more minority students with persisting and completing undergraduate STEM programs (Anderson, 2003; Owens, 2009).

Method

This phenomenological study was designed to bridge the gaps between the identification of institutional best practices and the persistence factors that enhanced Louis Stokes Mississippi Alliance for Minority Participation (LSMAMP) students' persistence and degree attainment in Science, Technology, Engineering and Mathematics (STEM).

The research explored the following questions; (1) What specific programs and instructional activities and experiences attract students to STEM fields and enhance degree attainment of minority student in LSMAMP program? (2) What precollege and college persistence experiences increase LSMAMP student interest, retention, and bachelor's degree attainment in STEM disciplines? (3) What perceived strategies are successful in ensuring LSMAMP student success from an institutional, instructional, and student persistence perspective? (4) What relationships exist between LSMAMP degree attainment and responses from students and faculty regarding identified institutional best practices and programs, persistence factors and experiences?

After obtaining IRB approval, the following qualitative methodological approach was utilized to conduct the studybased on the research questions.

Qualitative Methodology

The methodology employed for this study was a phenomenological approach given that such an approach is appropriate for capturing the subjective understanding of individual participants (Marshall & Rossman, 2016). A phenomenological approach seeks to understand the individuals' lived experiences with a particular phenomenon. As such, the researchers endeavored to explore, describe, and analyze the meaning derived from the study participants' experiences. Using a phenomenological approach yielded descriptions that provided the foundation for introspective structural analysis to gain an understanding of the essence of the shared experiences of the study participants.

The researchers assumed that this phenomenological approach would provide insights into the need for understanding institutional best practices and persistence factors that enhance LSMAMP students' degree attainment in STEM using the integration of Kolb's Theory of Experiential Learning and Roger's Diffusions of Innovations Theory. Moreover, it was also assumed that a qualitative research design methodology was best suited for gaining insights into the area being researched. The researchers operated under the assumption that all participants responding to interview questions would respond to their best ability and with honesty.

Site Selection

This study focused on the nine Mississippi LSAMP NSF funded institutions within the current five-years funding circle. The universities and colleges are made up of nine campuses located across multiple communities and municipalities which allowed for an opportunity to observe and understand the institutional practices and the experiences of LSMAMP students and faculty at the various sites.

Population and Sample Selection

This study focused on engaging LSMAMP sophomore, junior, and senior students in STEM as well as coordinators in the programs from the nine sites. The researchers employed a purposive sampling technique in the selection of candidates. Purposive sampling technique, which is sometimes referred to as judgement sampling, is the deliberate selection of a participant due to the traits the participant possesses and how those traits align with the phenomena being studied (Etikan, 2016).

The researchers ensured that there were participants from all colleges and universities identified in the sampling frame. LSMAMP students and five coordinators from the campuses were interviewed. The target population were those sophomore, junior and senior students and program coordinators currently engaged in the LSMAMP program.

Collection of data began after identifying candidates to be interviewed through the researchers' knowledge of individuals currently functioning in the positions previously outlined, the program gate-keepers, and referrals from identified potential candidates. Initial contact with prospective candidates was made via phone to make introductions, provide an overview of the study, and to schedule a Zoom or telephone interview. The initial call, on average, took approximately 10–15 minutes.

After the initial call, prospective candidates were officially invited to participate in the study using a standardized email. The correspondence outlined the purpose of the study, requirements for participation, and the process for securing their privacy as well as the informed consent form for review. A Zoom link with a password was sent to the prospective participants to confirm the date and time of the interview. Candidates were asked to review, sign, and return the informed consent form before the scheduled interview.

As previously indicated, interviews were conducted using a secure Zoom online meeting platform, telephone or electronic survey.

Eighteen students and five coordinators were selected to participate in face to face or telephone interviews and surveys. Due to the Covid-19 pandemic, interviews were conducted using the Zoom online platform and electronic survey. Recruitment was continued until saturation was achieved. Theoretical saturation was reached upon completion of the twenty three interviews. As such, the researchers determined that no further interviews were deemed necessary. This ceasing point is in alignment with Creswell (2013) which suggested that a study group should consist of three to fifteen members who can articulate the lived experiences with the phenomenon being studied. Further, researchers have asserted that qualitative studies usually focus on in-depth, relatively small samples (Patton, 1990) and that small sample sizes are useful in providing rich cultural descriptions (Marshall & Rossman, 2016). The use of interviews, guided by questions grounded in the Experiential Learning and Diffusion of Innovation framework, allowed for deeper insights into the perceived institutional best practices, instructional experiences, and persistence factors that enhanced LSMAMP students' degree attainment in STEM.

Data Collection

Data collection began after approval was granted by Jackson State University Institutional Review Board. All interviews were recorded with consent from the participants which aided in the accuracy of coding responses. Interviews lasted approximately 35 minutes. The interviews were conducted using an interview guide consisting of statements, follow-up and guided questions.

The first set of questions for the student participants focused on demographic information and other relevant background questions. These were followed by specific questions related to the research questions of the study. The participating coordinators questions gauged their perceptions of institutional best practices and instructional strategies relative to student persistence and degree attainment in STEM.

After the interviews, the audio recording was uploaded to Trint, an artificial intelligence (AI) transcription platform. Trint uses AI to transcribe documents from voice to text and holds the ISO 27001certification. This certification was created by the International Standards Organization to provide a global standard for information security management systems (ISMS) and is considered the platinum standard for data security.

This platform was used to increase the efficiency of capturing and transcribing data. This method of software transcription has been noted to increase effectiveness while eliminating exorbitant amounts of transcription time (Tessier, 2012).

Journaling and follow-up interviews were used as data collection methods to provide insights on the study.Journaling refers to the practice of keeping a diary or journal that enables the researchers to explore the thoughts, perceptions and attitudes of study participants.

Data Analysis

Data analysis was codified into six phases: organizing data, immersion in the data, generating possible categories and themes, coding the data, interpreting data, and exploring alternative understandings of findings from the data (Marshall & Rossman, 2016). Methods for organizing the data included using an information log that outlined the dates, times, people, as well as initial observations from the interviews. Initially, this information was recorded in Microsoft Office with later reflective memoing captured in ATLAS. ti, a Qualitative Data Analysis (QDA) software program.

Immersion of the data took the form of becoming intimately engaged with the data collected by reading and rereading the material (Marshall & Rossman, 2016). Once the data weretranscribed, the researchers read through the transcription in conjunction with the interview recording. During the process, revisions were made to the transcript to accurately capture the responses from the study participants. Pre-coding was used to highlight intriguing quotes or phrases for later consideration. This allowed the researchers to consistently reflect on the people, events, and the phenomenon to help shape the interpretation of the data.

Given the amount of data collected, the researchers engaged in the process of data reduction. This exercise of reducing data provided the researchers with the opportunity for further immersion in the data that led to the recognition of categories and underlying themes. Connections between these categories and themes were applied during the second stage of analysis whereby the researcher's understanding of the participants' perceptions was used to shape the organization of the data for interpretation in the final document.

ATLAS. ti v8 was used for further organization of data and aided in the process of generating categories and themes. In the first stage of analysis, transcripts from each interview were uploaded into the system. Open coding or in vivo coding was used to identify core themes and better inform inductive and deductive thinking to analyze the information collected. During this stage of analysis, the researchers were able to define general codes and themes which allowed small segments of data to be considered in detail and compared with one another. Any line or paragraphs of data that could be considered relevant was coded, resulting in 30 initial codes. These codes were merged into similar codes followed by a grouping into larger or "meta" categories.

In the second stage of analysis, axial coding was used to further refine, align, and categorize emergent themes. These themes were aligned with the study framework and research questions. The researchers generated outputs that queried information coded to the research questions typographies. In the third stage of analysis, eight categories emerged from clustering the coded data. The categories were further merged due to overlapping of categories that formed the basis of the findings.

Biases

Given that it is very difficult for a researcher to divorce himself/herself from the data being analyzed in qualitative research, some strategies were employed to avoid bias and maintain objectivity.

One method identified by Marshall and Rossman (2016) is that of documenting field notes dedicated to self-reflection. They recommended that the researcher allocates time to consider what worked and what did not work and examine own emotions and how those feelings may lead to deeper insights about the phenomenon being studied. With this in mind, after each interview, the researchers took the time to detail overall impressions from the interview and key themes that were heard to channel those emotions into tools that were used to inform the research.

Additionally, to ensure the validity of the findings, the researchers used the following methods: engaged study participants to review the results, identified multiple data sources such as the LSMAMP existing data base to validate findings, and explored alternative explanations of the data findings. By allowing interview participants to review results, the researchers were able to ensure that the interpretations were a true representation of what the participants wanted to convey. Additionally, using multiple data sources provided increased confidence in the research findings while allowing for creative ways to study the proposed phenomena. Finally, exploring other alternative explanations for the data findings allowed the researchers to rule out or account for these alternative explanations resulting in stronger support for the interpretations of the data.

Trustworthiness

Historically, the concept of trustworthiness has been grounded in the natural and experimental sciences, characterized by qualitative criteria such as reliability, validity, objectivity, and generalizability (Marshall & Rossman, 2016). However, alternative constructs have been offered by researchers as a means to uphold the tenants of trustworthiness that is better aligned to qualitative design methods. Researchers Lincoln and Guba established a set of procedures that could be used in qualitative research which includes prolonged engagement, member checks, and peer debriefings (Marshall & Rossman, 2016).

In prolonged engagements, the researcher is present in the setting for long periods. Additionally, the concept of member checks encourages the researcher to share his/her interpretations of the data with the participants interviewed. Peer debriefings involve the researcher triangulating data using multiple sources through multiple methods and discussing emerging themes and trends with other knowledgeable researchers in the field. These procedures align with the validity/credibility concepts in qualitative studies.The option to be present in the setting for long periods was not viable due to campus closures in response to the Covid-19 pandemic. However, the utilization of member checking and peer debriefings served as validation methods.

Qualitative Findings

Description of Participants: Eighteen (18) undergraduate LSMAMP students were interviewed for this study. An additional interview/survey of five (5) LSMAMP site coordinators were also conducted to gauge information on their understanding of best practices and persistence factors that enhance LSMAMP students degree attainment in STEM. All students interviewed were African Americans comprising of seven (7) males and eleven (11) females within the age range of 19 – 21. There were eight (8) seniors and ten (10) juniors. Current GPA ranged from 3.5-3.9 on a scale of 1 to 4.

Table 1 is a demographic description of the representative sample of the students interviewed. Study participants identities were protected through the use of pseudonyms.

Table 1: Demographic Description of Sample

Name (Pseudonym)	Age	Gender	Transfer Yes/No	GPA	Major	Class
Ron	21	Male	Yes	3.7	Chemistry	Senior
Meca	21	Female	Yes	3.7	Biology	Senior
Audora	21	Female	Yes	3.7	Biology	Senior
Deja	20	Female	Yes	3.8	Biology	Junior
Tony	21	Male	Yes	3.9	Engineering	Senior
Gina	20	Female	No	3.9	Biology- Pre Medicine	Junior
Eliza	21	Female	No	3.9	Computer Science	Senior
Wilbur	20	Male	No	3.6	Electrical Engineering	Junior
John	21	Male	No	3.6	Electrical Engineering	Junior
Kristy	20	Female	Yes	3.6	Biology- Pre Medicine	Junior
Yolanda	19	Female	No	3.5	Computer Science	Junior
Stephanie	21	Female	Yes	3.6	Biology- Pre Medicine	Senior
Nina	20	Female	No	3.7	Biology	Junior
Thomas	21	Male	No	3.5	Mathematics	Junior
Stephen	20	Male	No	3.6	Chemical Engineering	Junior
Marlon	21	Male	No	3.5	Chemistry	Junior
Nycole	21	Female	No	3.7	Biochemistry	Senior
Shirley	20	Female	No	3.6	Biology	Senior

Phenomenological Analysis

In this section, five main themes which emerged from the interviews and surveys are summarized: (1) early exposure to STEM and familial support; (2) hands on involvement and academic intervention activities; (3) Peer group support; (4) institutional environment and infrastructural support; and (5) financial incentives.

Theme 1: Early Exposure to STEM and familial support

Early exposure to STEM was a commonality among all participants. Most of the participants cited rigorous high school academic preparation as important to their interest and success in STEM. Taking advanced placement (AP) honors classes in high school, pre-college summer bridge or transitional program provided focus and interest for them in STEM disciplines. Most of the participants cited parental and extended family support as instrumental to their interest, persistence and success in STEM. The following are some of the participants' reflections of their experiences.

Ron stated the following about his parents putting him in STEM summer camps each summer; "I feel like that played a pivotal role in us being nurtured and prepping for that [STEM major]". He went on to declare:

Because I think my dad and mom knew that being in summer camps around like-minded individuals around that time of our lives…When you're being honest, a lot of kids, in general, probably wouldn't want to have, or be in summer camps that dealt with scholastic things. They put us in fun camps, where we learned and where we enjoyed it. That helped us to sustain and maintain our interest, and to actually increase our interest in choosing that as a major. I know once I hit sixth grade, literally, the summer going into seventh grade, the summer going into eighth, the summer going into ninth, all the way until, I think, my junior year, they always made it that we always were in one type of STEM related camp every summer. I remember there was one summer where they had me in three camps.

Ron went on to further explain how these camps provided him with opportunities to meet more people with similar STEM interest who were "striving for" a similar goal in life and often times did not share the same ethnicity as him. He stated that the rigor of the summer camps pushed him to be greater and think harder. Tony also discussed how he attended math and science camps as a young child and continued to support his math and science aspirations by ensuring that he continued to get consistent exposure to math and science skills during his adolescent years.

Eliza expressed how at the age of 15, she used to help her father take computers apart and how her parents would check out STEM related books from the library which assisted in maintaining her interest in engineering. Wilbur confirmed that his father's love for engineering and consistent visits to his father's work site is what continually inspired him to continue the journey to a STEM degree. Stephen also stated his parents put him in summer engineering, technology and robotics camps as early as elementary age building robots to software development. He acknowledged that this consistent early exposure helped to strengthen his technology and engineering mindset for his future.

Marlon declared that his parents were his main influences for attending college and majoring in STEM, stating, "They somewhat indoctrinated me with their past experiences. They were the ones that told me I definitely want to pursue higher education, go to college." He also explained that, "They enrolled me into the gifted program when I was in elementary, middle, and high school. I attended math camps, science camps, and also they were just very supportive in terms of whatever I wanted to do. Math and science, they just were there to support me". Marlon was an only child and spent a lot of time playing any type of memory or critical thinking games such as Chess, with his parents. He states, "…they were always there to help me figure things out, by letting me figure it out myself".

In addition, study participants spoke of particular friends, siblings, teachers, and guidance counselors who facilitated their preparation to be STEM majors. For example, Nina shared her experiences as such:

My friends and siblings who were already in college, encouraged my interest in STEM as a major. Some of my teachers and guidance counselor, made sure I was registered in appropriate college preparation classes and mentored me about college options.

This sentiment was also shared by a number of the participants. As noted by Andrea, "Being an honor student, with approachable counselors and friends, can make for a smooth transition to being a STEM major".

Theme 2: Hands-On Involvement and STEM Academic Intervention Activities

The second theme was the value the participants placed on their involvement in LSMAMP STEM academic intervention activities. The majority of the participants recognized the role of mentoring, engagement in hands-on research, tutoring, workshops, and academic advising as program best practices that enhanced their persistence and degree attainment in STEM.

On mentoring, Deja, a biology major, shared that having a supportive network of LSMAMP students, faculty, and staff mentors were central to her academic success and persistence in STEM. Specifically, she noted:

When I have challenges in understanding class assignments or personal issues, my senior cohort mates and Program Director were always available to help me overcome the challenges. My professors were readily available to provide me with guidance on class assignments and time management.

Participants also stressed how being involved in workshops and seminars that were organized by LSMAMP program offices enhanced their academic activities designed to impact knowledge, refine skills, and build external professional contacts that were instrumental to their persistence and success. Kristy summarized the reflections of the majority of the participants when she said:

I have benefited immensely from LSMAMP workshops and seminars where different speakers were brought to campus to share their knowledge on topics like test preparation (GRE), career exploration, study skills, time management skills. Exposure to these workshops and seminars have made me a better student and motivated me for graduate work or career employment when I complete my undergraduate degree.

Majority of the participants shared their enthusiasm on being exposed to hands-on research by their faculty mentors/tutors and opportunities to attend and present their research at professional meetings through LSMAMP program strongly influenced their persistence and success in STEM. As Shirley shared, "Working in the lab and conducting experiments with my faculty mentor gave me the confidence to complete my research and present my work during a poster session at the Mississippi Academy of Sciences joint conference with LSMAMP program". Nycole shared similar sentiments when she posited:

My research experiences attending and presenting my work at STEM conferences as an LSMAMP Scholar has helped to clarify my career plans and enhanced my sense of self-efficacy. Before being selected to this program I was lacking confidence and productive interaction with my fellow students and professors.

Theme 3: Peer Group Support

The participants discussed the importance of having peers with similar aspirations of doing well and supporting each other in their major disciplines. Specifically, they mentioned that group study interactions helped them to comprehend and retain class materials. For example, Deja who is a junior Biology major explained, "I had challenges understanding some of the concepts in class, however, once I met with my study group, some of my classmates helped to explain the ideas in such a way as to make me understand and apply the concepts better". Forming a bond with other LSMAMP scholars was helpful to John because he did not want to disappoint them being dropped from the program. He shared the following:

Although we compete as individual students, we also see the competitive advantage for being LSMAMP scholars studying together and learning from each other. I would not have survived Advanced Calculus and other high level engineering classes without the help of my peers.

Some participants from PWI's stressed the social aspects of studying together and mitigating some of the stressors of being a minority in a majority white STEM student environment. Eliza put it succinctly, "Without the LSMAMP peer group support and the social and academic relationship I have developed, I would have changed my major to a non-STEM major". Upon reflection, Yolanda believed that the family atmosphere and comradery from her peers, helped her to stay focused and continue to persist in her pursuit to complete her degree in Computer Science.

Theme 4: Institutional Environment and Infrastructural Support

In response to research question # 3, "What perceived strategies are successful in ensuring LSMAMP student success from an institutional, instructional, and student persistence perspective", interviews and/or surveys were conducted with five out of the nine LSMAMP Site Coordinators.

The Coordinators (identified as coordinator 1 through 5) underscored the positive STEM environment and institutional support as critical components of LSMAMP best practices for student persistence and success.Specifically they identified evidence-based teaching practices, strategic and consistent communication channels, institutional commitment and alignment to existing infrastructure, and participation in a learning community as enhancers of LSMAMP students' success.

Coordinator 1 shared the following:

The LSMAMP environment encourages evidence-based teaching practices that have been shown to enhance engagement and deep learning by promoting the use of active learning pedagogies, increasing access to experiential learning, field experiences and research for students. We also promote project based assessments to evaluate and validate our students learning.

Coordinator 3 noted as follows:

Our program encourages skill and mastery focus that utilizes performance standards to measure students' success. In addition, the LSMAMP environment creates opportunities for students to be engaged in field experiences and other service learning opportunities within and outside of the institution.

Coordinators 4 and 5 shared similar sentiments with regard to the instructional practices in their institutional environments. For example, Coordinator 5 posits;

In my institution, we use peer coaching strategy and foundation courses assistance to meet the needs of our students. Monthly meetings and activities designed to solve individual and group academic and social problems of students constitutes parts of our programming environment.

The Coordinators noted the importance of consistent communication channels as a part of their environmental ethos. Coordinator 1 shared the following:

From the state level, Site Coordinators meet monthly to discuss ways we can share activities and resources within the alliance. We also discuss potential supplemental funding opportunities that would provide additional support to the IMAGE scholars. Finally, we discuss ways to build on the success of different aspects of LSMAMP.From the university level, our Student Executive Board meets twice a month to discuss new ideas and methods that would better meet the scholars' needs. We also discuss community service opportunities and bring in IMAGE alumni for networking and community building experiences. The executive board also discuss ways to collaborate with other organizations and programs (Luck Day, NOBCChE, NSBE, McNair Program, MAPS, etc.) to facilitate research and various learning opportunities. Finally, the executive board share innovative ways to utilize social media (Facebook, Instagram, Twitter, etc.) for advertisement and recruitment purposes.Surveys are sent to scholars after every event to receive feedback on how to improve the activity. At the conclusion of the student's research experience, questionnaires are also sent to research faculty to gather information on the development of the student throughout the capstone research experience.

Coordinator 3 emphasized the importance of open communication with program students in enhancing their learning and persistence in STEM. Specifically she noted:

We have monthly meetings among our site coordinators to discuss ways to manage and enhance our site programs. Students lead information sessions where challenges and opportunities for student engagement are discussed. This process has helped to encourage students' ownership and sharing of information within the Alliance and among students.

The importance of institutional support for LSMAMP program success was stressed by all the coordinators interviewed. Coordinator 2 surmised as follows:

My institution is very supportive of our LSMAMP program. Our students are provided; (1) dedicated space with technology support and access to a writing center to enhance their skill sets. The coordinator and faculty have access to our Okialert system to monitor students' academic and social support through the Student Success Center. The institution also provides faculty mentors with release-time to conduct research and publications with our students.

Coordinators 1, 3, and 5 shared other institutional support to include; (1) stipends for faculty and student travel and purchase of consumables and supplies needed to support research, (2) dedicated space in the library and program offices for LSMAMP students, and (3) institutional recognition of LSMAMP students and faculty mentors during academic year end banquets.

Coordinator 1 said the following about the importance of her institutions LSMAMP as a learning community:

Participating in the LSMAMP learning community enhances student persistence and success by providing students multiple opportunities to stay active while offering guidance and support. The following activities have been designed to foster professional development, community and leadership building by demystifying the graduate level experience and promoting a well-versed student. These efforts serve as a catalyst in the retention and production of successful students.

These activities are: (1) Seminars in personal statements & resume writing, (2) GRE Prep Workshops, (3) Departmental STEM Seminars, (4) Graduate School Workshops, (5) Community Services Projects, (6) Leadership Retreats, and (7) Participation in STEM Organizations.

Coordinator 3 shared similar sentiments about her institutional LSMAMP program when she posited:

Our learning community has provided opportunities for our students to learn as a cohesive group with shared aspirations and goals. They learn team work and engage in group professional development activities as well as personal growth.

Coordinator 4 shared that her institutional LSMAMP program is relatively small with limited students and faculty mentors. However, she aspires her program to be a learning community over time.

Theme 5: Financial Incentives

All student participants acknowledged the significance of financial support to their persistence and success in STEM. They used one or more forms of assistance (scholarships, grants, loans) to meet their financial obligations. The LSMAMP tuition and stipends were particularly stressed by the participants as critical to their success. For example, Stephen an engineering major shared:

Coming from a low SES background it would have been impossible for me to major in engineering without the financial support from the LSMAMP program. My engineering books and lab accessories are very expensive. I would have changed my major were it not for the financial aid I received as an LSMAMP scholar.

Ron, Andrea, and Yolanda discussed the stressors of working and going to school and their impact on grades and retention. Yolanda shared:

First, I would have dropped out of school as a STEM major without the LSMAMP financial support. Having maintained a full-time job and schooling full-time before I became an LSMAMP student took a toll on me physically and mentally. My grades then were not something to be proud of. The LSMAMP program financial incentives has enabled me to fulfil my dreams and reach my academic full potential.

Ron spoke of the assistance from the LSMAMP program office in helping him to navigate through the financial aid process and other scholarship opportunities. He stated "The LSMAMP director provided us with various financial aid opportunities in addition to LSMAMP scholarship and stipends. The workshops on financial aid and financial literacy in addition to other programs scholarship opportunities helped me much". Ron's positive experiences was also shared by the other participants in the study.

Discussion

In conducting this exploratory study, the authors sought to gain insight and understanding about institutional best practices, instructional experiences, and persistence factors that enhance Mississippi's LSAMP student degree attainment in STEM. This study was guided by interview and survey data on STEM students and site coordinators to gauge institutional best practices and persistence factors that support desired student academic outcomes.

Research from the phenomenological analysis yielded five themes that were consistent with similar studies.

First, the results indicate that early exposure to STEM and familial support were important to LSMAMP students' field of choice and preparation for baccalaureate academic experiences and success. This was reinforced by taking advanced placement (AP) honors classes in high school, pre-college summer bridge program provided by LSMAMP as a recruitment strategy provided focus and interest for the students in STEM disciplines. Participants' reflections of familial support were instrumental to their strong interest, persistence, and success in STEM. This is consistent with Furstenberg and Hughes (1995) research positing that strong family support, sometimes extending well beyond the immediate family, equipped students to persist through challenges. LSMAMP practice of creating a familial environment that is supportive of students' social and academic needs served as a pathway for student professional growth and academic enhancement that had a positive impact on their performance and persistence in STEM disciplines. This finding is supported by the research of others (Guifrida, 2005; Slaughter-Defoe et al, 2006; Griffin Toldson, 2012).

Another significant result is the value study participants placed on their involvement in LSMAMP STEM academic intervention activities. They recognized the role of mentoring, engagement in hands-on-research, tutoring, workshops, and academic advising as program best practices that enhanced their persistence and degree attainment in STEM. This is consistent with the preliminary survey results from LSMAMP faculty and coordinators agreement with the importance of these factors on the LSMAMP best practices and student success towards STEM degree attainment.

Study results showed the importance of having peers with similar aspirations of doing well and supporting each other in their major disciplines as critically important in LSMAMP students' academic success and persistence. Specifically, the students mentioned that group interactions helped them to comprehend and retain class material. The integration of learning communities, familial type groups within their discipline and open communication provided them with collaborative learning environments and a sense of belongingness among students and faculty mentors. Consistent with this study's diffusion of innovations framework, communication is more effective when individuals "share common meanings, a mutual subcultural language, and are alike in personal and social characteristics, the communication of ideas is likely to have greater effects in terms of knowledge gain, attitude formation in change, and overt behavior change." (Rogers, 1981). Relative to the question of strategies that ensure LSMAMP student success from an institutional, instructional and student persistence perspective, participants underscored the positive STEM environment and institutional support as critical components of LSMAMP best practices for program success. The utilization of evidence-based teaching practices, innovative communication practices within the alliance, shared resources with other institutional STEM programs, faculty and students institutional support were cited by participants as reasons for program success.

Finally, participants indicated that financial support (stipends, scholarships, grants, loans) enhanced their persistence and success towards their degree attainment. Studies suggest that minority intervention programs in STEM tend to recognize the importance of financial support to students. A report by the U.S. Department of Education (2000) found science and engineering degree completion to be positively related to receiving financial aid from school. National studies have consistently found student aid to be a positive influence on persistence (St. John EP, 1991).

Conclusion

The results of this study illustrate the importance of monitoring the progress made by STEM programs and the access and opportunity offered to colleges and universities for development of minority STEM students, as educational leaders strive to increase the level of STEM programming. There continue to be a great need for universities to strive to increase the graduation rates of African Americans and other minorities in STEM fields. An increase in the professional development of African American and minority students in the STEM field will position the US to be more competitive in the global economy as students develop to become leaders in the technical workforce.

The funding provided by the NSF LSAMP initiative has enabled Mississippi's higher education institutions to make progress towards closing the gap in the education and training of minority students ensuring that they can find opportunity for success in the STEM disciplines.Continued attention to the development of African American and minority STEM professionals will ensure that graduates will be in a position to make meaningful contributions to science and other technical areas that will eventually benefit their communities and its constituents.

References

Anderson, E., & Kim, D. (2006). Increasing the success of minority students in science and technology. American Council on Education. Washington, DC.

Adelman, C. (2006). The toolbox revisited: Paths to degree completion from high school through college. The U.S. Department of Education. Washington, DC.

Bybee, R. (2006). The science curriculum: Trends and issues. Teaching Science in the 21st Century, 21-37.

Borrego, M. and Henderson, C. (2014). Increasing the use of evidence-based teaching in STEM higher education: A comparison of eight change strategies. Journal of Engineering Education, 103 (2):220-252.

Business Higher Education Forum (2013). The U.S. STEM Undergraduate Model. Applying System Dynamics to Help Meet Obama's Goals for One Million STEM Graduates and the U.S. Navy's Civilian STEM Workforce Needs.

Depass, A., and Chubin, D. (2008). Understanding interventions that encourage minorities to pursue research careers. American Society for Cell Biology. Retrieved from:
www.coss.org/diversity/reports/08Understanding_Interventions.pdf.

Donnelly, M. (2008). STEM fields & STEM education. Research Starters Education, 11:1-12.

Elrod, S. and Kezar, A. (2015). Increasing student success in STEM. American Association of Colleges and Universities. Retrieved from: http://www.aacu.org/peerreview/2015/spring/elrod-kezar.

Espinosa, L. (2011). STEM Literacy beyond STEM occupations. Diverse. Issues in Higher Education. Retrieved from: www.ihep.org/stemwatch.

Gay, G. (2000). Culturally responsive teaching: Theory, research, & practice. New York, NY: Teachers College Press.

Golde, C. (2005). The role of the Department and Discipline in doctoral student attrition: Lessons from four departments. Journal of Higher Education, 76 (6): 669-700

Gorski, P. (2009). Key characteristics of multicultural curriculum. Retrieved from http://www.edchange.org/multicultural/curriculum/characteristics.html

Griffith, A. (2010). Persistence of women and minorities in STEM field majors: Is it school that matters? Economics of Education Review, 29(6), 911-922.

Institute of Medicine. (2011). "Expanding Underrepresented Minority Participation: America's Science and Technology Talent at the Crossroads". Washington, DC: The National Academies Press. https://doi.org/10.17226/12984.

Kolb, D. (1984). Experiential learning: Experiences as the source of learning and development. Englewood Cliffs, NJ: Prentice-Hall.

Kuh, G., and O'Donnell, K. (2013). Ensuring quality and taking high-impact practices to scale. Association of American Colleges and Universities. Retrieved from: http://www.fullerton.edu/HIP/_resources/documents/Ensuring%20Quality%20and%20Taking%20High-Impact%20Practices%20to20Scale.pdf.

Lane, T.B. (2016). "Beyond academic and social integration: Understanding the impact of a STEM enrichment program on the retention and degree attainment of underrepresented students". CBE-Life Sciences Education, Vol. 15 No. 3, ar39. https://doi.org/10.1187/cbe.16-01-0070

Lee, D., and Harmon, K. (2013). The Meyerhoff Scholars Program: Changing minds, transforming a campus. Metropolitan Universities, 24(2):55-70.

Lenning, O. & Ebbers, L. (1999). The powerful potential of learning communities: Improving education for the future. ASHE-ERIC Higher Education Report, 26(6).

National Center for Science and Engineering Statistics (2013). Baccalaureate origins of U.S.-trained S & E Doctorate Recipients. Retrieved from: http://www.nsf.gov/statistics/

NSF (2014). Investing in Science, Engineering, and Education for the Nation's Future, Strategic Plan for 2014-2018. Arlington, VA: National Science Foundation. Retrieved from www.nsf.gov/pubs/2014/nsf14043/nsf14043.pdf

National Science Foundation (2018). HDR: Harnessing the Data Revolution.

Owens, T. (2009). Improving science achievement through changes in education policy. Science Educator, 18(2).

Riegle-Crumb, C., and King, B. (2010). "Questioning a white male advantage in STEM: Examining disparities in college major by gender and race/ethnicity", Educational Researcher, Vol 39 No. 9, pp. 656-664. https://doi.org/10.3102/0013189X10391657

Riley, D. (2015). A way up for low-income students. ASEE Prism, 24(7), 44.

Rogers, E. (1981). Diffusions of Innovations (3rd ed.). New York: Free Press.

Tennant, M., & Pogson, P. (1995). Learning and change in the adult years: A development perspective. San Francisco, CA. Jossey-Bass.

Toven-Lindsey, B., Levis-Fitzgerald, M., Barber, P. H., and Hasson, T. (2015). "Increasing persistence in undergraduate science majors: A model for institutional support of underrepresented students". CBE-Life Sciences Education, Vol. 14 No. 2 ar12. https://doi.org/10.1187/cbe.14-05-0082

United States Census Bureau (2013). Disparities in STEM employment by sex, race, and Hispanic origin. Retrieved from: https://www.census.gov/prod/2013pubs/acs-24pdf.

United States Department of Commerce (2011). Recent and Projected Growth in STEM and Non-STEM Majors. Retrieved from: http://www.esa.doc.gov/sites/default/files/stemfinalyjuly14_1.pdf

Watkins, J., Mazur, E. (2013). Retaining students in Science, Technology, Engineering, and Mathematics (STEM) Majors. Journal of College Science Teaching, 42(5).

Wells, C., & Grabert, C. (2004). Service-learning and mentoring: Effective pedagogical strategies. College Student Journal, 38, 573-578.

Whalen, D. and Mack, S. (2010) Academic success for STEM and Non-STEM majors. Journal of STEM education, 11(1).