



## **KS-LSAMP Pathways to STEM: A System Approach to Minority Participation in STEM**

**Dr. Bette Grauer P.E., Kansas State University**

Assistant Dean for Retention, Diversity, and Inclusion, Kansas State University

**Linda P Thurston Ph.D., Kansas State University**

Linda P. Thurston, Ph.D., is Associate Dean for Research in the College of Education at Kansas State University and Lydia E. Skeen professor in the Department of Special Education, Counseling and Student Affairs. She served as a program director (IPA) with the National Science Foundation in the disability, gender and evaluation programs. Thurston has been PI on NSF and USDE awards for gender and disability projects, and is currently co-PI on the KS-LSAMP project. Her research foci include gender and disabilities issues in post-secondary STEM education, mentoring and program evaluation. Thurston has conducted research and taught about disability, gender and evaluation issues for over 35 years.

**Dr. Beth A Montelone, Kansas State University**

Professor of Biology and Associate Dean for Research, College of Arts & Sciences

# **KS-LSAMP Pathways to STEM: A Systems Approach to Supporting Minority Participation in STEM**

## **Abstract**

The Kansas Louis Stokes Alliance for Minority Participation, KS-LSAMP, is an alliance led by Kansas State University (KSU) in partnership with three minority-serving community colleges in the southwest part of the state and a minority-serving private college in urban Kansas City, KS. All partner institutions in the KS-LSAMP project have established recruitment and retention programs aimed at serving the needs of underrepresented minority (URM) students including African-Americans, Native Americans/American Indians, and Hispanic/Latino students. The KS-LSAMP project builds upon foundations in place and allows expansion of efforts and extensive coordination among the partners to facilitate recruitment and retention of URM students in science, technology, engineering, and mathematics (STEM) programs of study leading to baccalaureate degrees at KSU.

The National Science Foundation funded project includes development of an innovative pathway for URM students in STEM that addresses unique institutional and student characteristics. Specialized activities are offered at critical junctures in the pathway, such as high school to college, two-year to four-year institutions, and the critical freshman to sophomore transition at 4-year institutions. The overall goal is to double the number of URM students graduating with baccalaureate STEM degrees from KSU within the five years of the project. In building the infrastructure to support this goal, the capacity of all partners will be enhanced, communication and coordination to facilitate the success of transfer students will be embedded in the culture of the partners, and other populations not currently well represented in STEM disciplines such as women, first-generation-to-college, and military-associated students also will benefit. In addition, best practices developed at KS-LSAMP partner institutions will be disseminated around the state to its other two- and four-year institutions that are increasingly serving URM students as well.

The project uses a systems approach to address the needs of underrepresented minorities in STEM, linking existing successful recruitment and retention strategies with new programs based on research into needs of underrepresented students. The project design is grounded in educational theories including retention/integration, cumulative advantage, engagement, and constructivism. It incorporates established best practices for working with URM students such as STEM identity formation through experiential programs including student research and internships, a focus on critical junctures, training of faculty and staff to enhance cultural competency, and building of academic integration and STEM self-efficacy. An extensive evaluation plan designed around the project logic model will be used as the basis for project assessment. This paper includes a description of the project, partner institutions, and first year research and evaluation results.

## **Introduction**

While the need to increase numbers of students in science, technology, engineering, and mathematics (STEM) degree programs is well established, less than half of students enrolled in

STEM programs of study graduate with STEM degrees.<sup>1</sup> Further, underrepresented minority (URM) students continue to be a small percentage of the students receiving STEM degrees. The National Academies propose doubling the number of underrepresented minority students receiving undergraduate STEM degrees.<sup>2</sup> Recruitment programming must be coupled with effective retention programs to achieve increases in underrepresented STEM graduates. An institution's ability to increase numbers of underrepresented students receiving STEM degrees is contingent on the support programs designed to retain the students.<sup>3</sup> Funding agencies, particularly the National Science Foundation, have provided support to improve retention of URM students. One of the most successful of these programs is the Louis Stokes Alliances for Minority Participation (LSAMP) program.<sup>4</sup>

This paper describes a new LSAMP program in Kansas created with the goal of doubling the number of baccalaureate degrees awarded to underrepresented minority students in STEM disciplines over the course of a five-year effort. The NSF funded KS-LSAMP project was created through a collaborative effort by the Kansas State University (KSU) Colleges of Agriculture, Arts and Sciences, Education, and Engineering. The project addresses recruitment and retention of minority students in STEM through a unique partnership of KSU, the state's land-grant university, with three minority serving community colleges and one minority serving private college. In a systems approach to project design and management, KS-LSAMP links existing successful recruitment and retention strategies with new programs based on research into needs of URM students.<sup>35</sup> The project is designed as a system of partner institutions and interconnected programs, which influence each other synergistically with the intent of producing the desired output, an increase in URM STEM graduates.

Partner institutions in the KS-LSAMP were selected because they serve the rapidly growing Hispanic/Latino population of the state and have strong existing ties to the land-grant university through programs funded by Federal and private agencies. Each Alliance institution identified new initiatives for this project to complement those already in place, providing synergy toward the overall project goal. These initiatives include focused and enhanced recruiting; development of detailed transfer guides; training for admissions personnel and academic advisors; student enhancement programs such as student research opportunities, internships, math immersion, and alternative spring break; a focus on career counseling; formal and peer tutoring; and implementation of improved student tracking. A particular focus of the KS-LSAMP is recruitment and retention of military veterans in STEM fields. Kansas is home to two Army bases and one Air Force Base and has a significant number of URM veterans enrolled in partner institutions.

## **Background**

Kansas is generally perceived as a state that is majority White, and U.S. Census data support this perception: in 2013, the proportion of the population identifying themselves as White, not Hispanic or Latino, was 77.1% in the state vs. 62.6% nationally. Hispanic or Latino individuals comprised 11.2% of the state population, Black/African American individuals made up 6.2%; Asian, Native American, and Hawaiian/Pacific Islander individuals making up 2.9%, 1.2%, and 0.1%, respectively.<sup>5</sup> However, comparing these data with those of the 2010 and 2000 Census show that the minority population of the state, particularly those identifying as Hispanic or

Latino, is growing rapidly: in 2000, Kansas was 7.0% Hispanic/Latino and 6.3% Black; in 2010, 10.5% Hispanic and 5.9% Black.<sup>5</sup> Kansas's school district enrollment data show the growing Hispanic/Latino population more dramatically: for the 2014-15 school year, 18.7% of the K-12 population identifies as Hispanic or Latino.<sup>6</sup> However, more work is needed in order to increase the proportion of Hispanic/Latino individuals in the high school, 2-year college, and 4-year college graduation populations; in 2012-13, the percentages of Hispanic/Latino individuals among the three groups were, respectively, 12.4%, 17.3%, and 8.6%.<sup>6</sup> The relatively high proportion of Hispanic/Latino students in the community college population was one of the bases for design of the project described in this paper.

At KSU, current undergraduate enrollment of Hispanic/Latino individuals is 6%, although this group is slightly less well represented in STEM fields and has a lower graduation rate than White, non-Hispanic/Latino students.<sup>7</sup> The underrepresentation of minority students in STEM undergraduate programs and their lower retention and graduation rates is consistent with national trends.<sup>2</sup>

## **Project Overview**

Kansas State University (KSU) leads the Kansas LSAMP project in partnership with three southwest Kansas institutions, Dodge City Community College, Garden City Community College, and Seward County Community College/Area Technical School, plus a minority-serving private institution, Donnelly College, in urban Kansas City, KS. All members of KS-LSAMP have established recruitment and retention programs aimed at serving the needs of underrepresented minority (URM) students including Black/African-Americans, Native Americans/American Indians, and Hispanic/Latino students. The new project builds upon the foundations in place and allows expansion of each partner's efforts, linkages to other existing Federal programs, and extensive coordination among the partners to facilitate recruitment and retention of transfer students to KSU. A perhaps unique feature of KS-LSAMP is its goal of improving recruitment and retention of military veterans in STEM fields. This reflects the locations of Fort Leavenworth, Fort Riley, and McConnell Air Force Base in the state and high enrollments of military-associated individuals and veterans at all partner institutions.

New programmatic offerings created as part of the project include a Math Boot Camp, STEM Alternative Spring Break, a Writing Lab, specific-by-major Transfer Advising Guides, a group visit to complement the Admissions Office's Transfer Student Visit Day, and a summer research experience program, Research Immersion: Pathways to STEM (RIPS). Since the partner institutions are two-year colleges, the emphasis of this project is on the transitions between high school and community college and community college and four-year institution. Academic, advising, and co-curricular activities are designed to help students negotiate these sometimes difficult transitions.

The project coordinates multiple existing efforts at all partner institutions aimed at improved recruitment and retention of URM students interested in STEM fields. There is a high degree of synergy with such programs, in part due to the fact that the project leaders are directly involved with some and collaborate with others. An extensive evaluation is designed to measure the impact of new programs on student participants and on the culture of each partner institution.

## **Expected Outcomes and Research Question**

The project will build a strong STEM pathway in the state for students from high school to the baccalaureate degree. We expect that as a result of this pathway, we will see an increase in the retention rates for URM students, as well as an increase in graduation numbers. Thus, the general research question for the project is: *How and to what extent does KS-LSAMP build and sustain a successful STEM pathway to the baccalaureate degree in Kansas?*

Intermediate term expected outcomes are:

1. Increased recruiter, advisor, and faculty understanding of issues for URM students in STEM;
2. Improved transition activities at critical junctures in STEM postsecondary education;
3. Successful transition of URM STEM students at critical junctures;
4. Increased numbers of URM students entering STEM postsecondary programs at all Alliance institutions;
5. Increased persistence and resilience of participating students;
6. Improved policies and programs at all Alliance institutions to promote success of URM students in STEM; and
7. Increased knowledge about “what works” for recruitment, retention, and graduation of URM STEM students in Kansas.

The primary research in the KS-LSAMP project takes the form of the formative and summative evaluation of the project, which is designed to provide evidence of the seven outcomes listed above. Formative evaluation data are collected to examine the results of the individual activities within and across the Alliance partners; and summative data are collected to examine the impact of the project activities, as a whole, on the students, the professional personnel who interact with the students, and the partner institutions. The project evaluation approach is discussed later in this paper.

## **Partner Institutions**

Kansas State University (KSU) is a public research university with a current enrollment of approximately 25,000 students. Founded as a land-grant institution, the main campus is located in Manhattan, Kansas. 75% of KSU students identify as White, while 11.6% of the population identifies as underrepresented minorities.<sup>7</sup>

The National Science Board has identified community college students as a large source of untapped talent and diversity for STEM.<sup>8</sup> In response, the KS-LSAMP project is designed as a partnership between a state university and minority-serving community colleges located in communities with growing minority populations. KSU has a strong recruitment presence in these communities, and many students from these populations come directly to KSU. However, we have found that a majority of them prefer to attend community colleges near their homes to save money and stay close to family. We chose to develop a partnership pathway between community colleges and KSU to encourage the transition to a four-year degree program in STEM.

KSU's partner institutions, Dodge City Community College (DCCC), Seward County Community College/Area Technical School (SCCC), Garden City Community College (GCCC), and Donnelly College (Donnelly), are Hispanic-serving institutions (HSI) with two-year programs that are transferable into STEM majors at KSU. These institutions have established recruitment and retention programs targeted specifically at the needs of URM students. The KS-LSAMP project allows expansion of these programs as well linkage to existing Title III, Title V, and TRIO programs. The KS-LSAMP team works to increase the two-year schools' URM recruitment and retention efforts, and to streamline transfer of their graduates to KSU into STEM baccalaureate programs.

Dodge City Community College (DCCC) with a 32% Hispanic/Latino enrollment is located in Ford County, KS (51% Hispanic/Latino). The college operates its own Spanish language radio station and advertises in a local Spanish newspaper and on the Spanish language television network, Univision. DCCC hosts statewide Hispanic Leadership Conferences for both middle and high school students. A Title V Developing HSI Department of Education (ED) grant has allowed DCCC to upgrade gateway courses with competency based curricula, educational technology, and active learning strategies; broadened access to student services specifically orientation, advising, financial aid, and tutoring; and enhanced ESL resources. A Student Support Service grant (targeted at first generation, low income, and/or disabled students) assists students with basic college requirements, motivates students to successfully complete their postsecondary education, and is leveraged to retain LSAMP students.

Seward County Community College (SCCC) located in Liberal, KS (57% Hispanic/Latino), has a Hispanic/Latino enrollment of 38%. A TRIO Student Support Services grant has helped the college enhance its retention services including academic advising, career advising, academic English and math tutoring, small peer group activities, peer mentoring, ESL services, and transfer assistance. Other retention-related programs at SCCC include a required one-credit course that helps guide students as they transition into college. The academic support services program includes a Student Success Center (peer tutoring, advising, career exploration), course placement assessment, an Academic Achievement Center, and a Mathematics Lab open to all students needing math assistance.

Garden City Community College (GCCC), located in Finney County, KS (43% Hispanic/Latino), has a 31% Hispanic/Latino enrollment. It hosts a variety of URM recruitment activities, including an annual Hispanic Student Leadership Conference for area high school students to discuss access to higher education and financial aid. GCCC employs two full-time admissions counselors who are bilingual and who work with prospective students and their families. GCCC focuses on providing URM student-tailored support groups and activities. GCCC hosts the Black Student Union organization as well as the Hispanic American Leadership Organization (HALO), whose goal is to nurture and encourage leadership skills in Hispanic students.

Donnelly College, a private institution located in Kansas City, KS (KCK) serves students from the Kansas City metropolitan area. Donnelly offers both two-year and four-year degree programs. However, the STEM-focused programs lead to associate degrees. Approximately 37% of students are Hispanic/Latino, 36% are Black/African American, and 85% are the first in their family to attend college. Donnelly recruits from all metropolitan area high schools, but focuses

on the KCK school district, which is over 50% Black/African American. Their joint College Opportunities/Readiness Ensured (CO/RE) program provides information to prospective students and their families about financial aid, college plans, grade and transcript awareness, the importance of attending class, and the economic advantages of a college education. Donnelly has also partnered with a Kansas City-based global engineering firm to develop a four-semester pre-engineering program for both high school and Donnelly students to promote awareness of college engineering careers and to break down the common fears associated with such careers. Each summer, Donnelly offers a five-week summer Transportation, Math, and Science Academy for area high school students, focusing on STEM academic enrichment and transportation career opportunities. Donnelly provides tutoring (free, full-time math, science, and English tutors), mentoring, and targeted career and academic advising. Peer-driven supplemental instruction is available for STEM classes.

### **Existing KSU Programs**

Multiple recruitment and retention programs, at both University and College levels, are in place at KSU. Some focus on campus orientation for first year students and others bring pre-college students to campus for hands-on recruitment events and/or summer experience programs. Undergraduate research is a key element to URM student retention and graduation, particularly in the STEM disciplines. Currently, KSU offers 14 undergraduate research programs in STEM during the academic year or summer, including NSF-funded REU Site programs in Biology, Chemistry, Mathematics, Physics, and Sustainability. While all programs encourage diverse student involvement, several specifically target URM students. The Developing Scholars Program (DSP) allows URM students to work during the academic year as research assistants with KSU faculty. This program provides academic, social, and financial support and works with the NIH-funded Bridges to the Future program to help retain Bridges students at KSU and in STEM disciplines once they transfer from their community colleges. The TRIO-supported McNair Scholars Program and KSU-funded Summer Undergraduate Research Opportunity Program (SUROP) target URM and first-generation students. The Diversity Offices in the Colleges of Agriculture, Arts & Sciences, and Engineering encourage the students they mentor to take part in these academic year and summer undergraduate research programs across campus. They also offer tutoring and peer group support services (e.g., MANRRS, Scholars Assisting Scholars, and the CONNECT newsletter for first year students and their families).

### **Theoretical Framework**

The conceptual framework for this project integrates four distinct and complementary theories: retention/integration theory, cumulative advantage theory, engagement theory, and constructivism. Retaining more URM students from their first year in college to degree completion is key to improving STEM completion. Research findings provide ample evidence for targeted, programmatic efforts that not only increase overall baccalaureate attainment but can also increase the number of STEM graduates.

Retention theory. Theorists<sup>9-12</sup> hypothesize that student degree progress and completion are influenced by social and academic integration within an institution. More recent integration theories also posit other aspects of the institutional environment that play a role in retention of

underrepresented students, such as climate and practices fostered by institutional agents.<sup>13, 14</sup> Researchers in retention theory suggest subcomponents of retention that will inform the work of this project: resilience, academic self-concept and identity.

Academically resilient students are described as students “who sustain high levels of achievement motivation and performance despite the presence of stressful events and conditions that place them at risk of doing poorly in school and ultimately dropping out of school” (Alva, p. 19).<sup>15</sup> Factors that impact resilience leading to persistence and completion are support (i.e. family and peer support; teacher feedback), a sense of belonging, and cultural loyalty.<sup>16</sup> Strong academic self-concept is also related to persistence for URM students in postsecondary education.<sup>17, 18</sup> Hernandez and Lopez<sup>19</sup> suggest that academic advisory staff facilitate the development of academic self-concept through encouragement, meaningful engagement and constructive critique and feedback. Identity is a particularly important concept in persistence and completion for STEM students. The development of a strong science identity has been shown to improve persistence among science majors<sup>20</sup> and to shape students’ trajectories within scientific disciplines.<sup>21</sup> Mentoring, recognition, and validation as competent in science by faculty and peers are identified as helping students develop strong, positive STEM identities. Hurtado et al.<sup>3</sup> found that undergraduate research experiences enhance student interest in becoming a scientist, as students improve their knowledge and understanding of science<sup>22</sup> and develop their professional self-confidence.<sup>23, 24</sup>

Engagement theory. Engagement theory<sup>25</sup> addresses the influence of meaningful involvement in learning through interactive and worthwhile tasks. When students are engaged they see the activity as personally meaningful, interest and persistence are promoted, self-efficacy is increased, and optimum academic performance is produced.<sup>26</sup> Researchers concerned about students’ disinterest and disengagement in STEM at the postsecondary level, especially among URM and women students, suggest that connecting content to professional applications or demonstrating its relevance to students’ lives also improves the STEM classroom experience.<sup>27</sup>

Cumulative advantage theory. The theory posits that a favorable relative position facilitates further relative gains.<sup>28</sup> In education, a cumulative advantage process is “capable of magnifying small differences over time and makes it difficult for an individual or group that is behind at a point in time in educational development...to catch up” (DiPrete and Eirich, p. 272).<sup>28</sup> Research on cumulative advantage suggests that students who, prior to college, have access to particular resources or experiences (i.e., parent in a STEM career, pre-college research experiences, recognition as highly competent in STEM) that helped develop relatively stronger STEM identities early on are more likely to have even stronger relative STEM identities in the future, especially since they tend to gain greater access to those important resources and activities during college.

Constructivist theory. Constructivist education is based on the theory that learning is iterative and integrative, with learners building upon their extant understanding by taking an active role in knowledge formation.<sup>29, 30</sup> Every interaction is a potential source of new information, which may or may not be congruent with the existing schemas. Student-centered, rather than teacher-centered, pedagogy promotes learning, academic self-concept, scientific identity, and persistence.<sup>29</sup>



This theoretical framework informs and guides the creation of new, innovative activities that build on and complement the existing programs to create an integrated system that supports the recruitment, retention and graduation of URM students in the pathway. The partners work collaboratively to produce a seamless and sustainable pathway for STEM student success.

## **System Components**

The work of the partners to develop and implement this pathway involves five system components: (1) project management, (2) recruitment materials and programs, (3) critical juncture programs, (4) retention programs, and (5) veterans' programs.

Project management. A central concept of the systems approach to project management requires that management recognize that the program exists as a system and that all parts of the system influence each other.<sup>35</sup> Ongoing communication among the alliance partners sustains and strengthens the system. Regular meetings of the Co-PIs, senior staff and partners are organized to discuss current issues related to student recruitment and retention. Team members monitor the ongoing status of the project and address critical academic issues such as admissions, financial aid, course and curriculum, advising and tutoring, career services, and professional development.

Recruitment materials and programs. A factor in increasing the persistence and graduation of URM students in STEM programs at predominantly White institutions is the campus climate for diverse students. As seen in the literature, institutions of higher education, particularly in STEM disciplines, often lack the pedagogical knowledge and skills needed to teach in culturally responsive ways.<sup>3, 13</sup> Therefore, STEM faculty and staff within the KS-LSAMP project will be provided multiple professional development opportunities related to cultural competence and awareness throughout the duration of the project. Alliance institutions all have strong existing recruitment programs focused on URMs that will be leveraged to meet the recruitment goals of the project. STEM recruitment materials are being developed for military and URM populations with key pieces translated into Spanish to reach and inform the targeted populations. Recruitment materials highlight Alliance partnerships and resources for students considering STEM programs of study.

Critical juncture programs. The project addresses the transition points at which attrition occurs, particularly for URM students: these are the transition from high school to higher education, two-year to four-year higher education institutions, and freshman-sophomore year. The project management team initiates and coordinates connection and transition protocols between the partner institutions and KSU. These include transfer agreements and transfer advising guides. Existing transition programs at partner institutions are complemented by shadowing opportunities at KSU for URM students from partner institutions.

Retention programs. Sessions/workshops/seminars for KS-LSAMP students feature URM STEM alumni and faculty and focus on STEM career exploration and research skill development. The KSU Academic and Career Information Center (ACIC) assists KS-LSAMP students in a comprehensive assessment and exploration of possible career paths related to their STEM majors. KSU hosts sophomore level students at the annual KSU Career Fair giving these students the opportunity to apply for an industry internship in the year before they enter KSU.

Multiple mentoring programs exist at the partner institutions and at KSU to help students adjust to college life and develop successful habits and practices for academic success. KS-LSAMP complements these existing programs with new mentoring programs that address the particular needs of URM students in STEM programs. Mentoring activities in KS-LSAMP target critical junctures for an entering freshman and transfer students to KSU. Freshmen and transfer student mentoring focuses on “transition to campus life” and includes socialization and orientation to create a STEM identity and develop STEM peer groups. Enrollment mentors assist freshmen and transfer students in connecting with their academic advisors and navigating the online enrollment system, and career fair mentors guide KS-LSAMP students through the KSU All University Career Fair.

A monthly LINKAGES seminar for KS-LSAMP students assists students in creating an identity as STEM students and KS-LSAMP students. Each seminar is infused with cultural context, identifying and reconciling cultural conflict within STEM disciplines. Other elements of the seminar include: industry tours, REU exploration, and help with scholarship searches (e.g., Marshall, Rhodes, Udall).

Within the literature of recruitment, retention, and resilience, activities most associated with retention of URM students are participation in research with faculty, summer bridge programs, and internships.<sup>4</sup> The KS-LSAMP project brings students from partner institutions to KSU for summer opportunities in undergraduate research, bridge programs, and internships. Two programs provide undergraduate research opportunities at KSU for KS-LSAMP students. First, KSU’s existing Developing Scholars Program allows KS-LSAMP students to participate in up to three years of research with an annual stipend. In the second, KS-LSAMP has created a new summer bridge research experience program in undergraduate research. The Research Immersion: Pathways to STEM (RIPS) program, located at the KSU campus, pairs underrepresented students with research mentors, for an eight-week summer research program. With the help and support of a faculty research mentor, students conduct an independent research project related to their area of focus and gain invaluable insight and skills in the areas of STEM in which they are most interested. The RIPS program is available to KS-LSAMP students during the summer between community college completion and KSU enrollment or in the summer after transfer. The program culminates with a poster presentation of the work conducted. RIPS leverages opportunities offered by other summer research experience programs at KSU, including the NSF-funded REUs, as well as the Summer Undergraduate Research Opportunity Program. SUROP coordinates a series of academic enrichment and social activities for all summer research students, including seminars on topics such as graduate school application and research ethics. The Federally-funded McNair Scholars program at K-State also provides peer interactions, enrichment, research experience, and graduate school preparation.

Veterans’ programs. The KS-LSAMP project includes a specific emphasis on recruiting and retaining veterans at all partner institutions. Located near Fort Riley, KSU is a designated military-friendly institution and was awarded one of NSF’s 17 research grants to institutions of higher education to develop programs and services aimed at easing the transition of military veterans into science and engineering. Collaboration with the KSU Offices of Veterans Affairs and Disability Support Services is included in KS-LSAMP recruitment, retention, and transition

activities. Distinct needs and support preferences of veterans are addressed,<sup>31</sup> including veteran-to-veteran support services such as tutoring, peer advising, and mentoring.

## Evaluation Approach

The project has planned and implemented a comprehensive program evaluation to provide both formative evaluation and summative evaluation information to the project leadership. The evidence-based design for the evaluation is a systems evaluation approach. Our evaluation team, from the Office of Educational Innovation and Evaluation, is utilizing the *Systems Evaluation Protocol*<sup>32</sup> developed at Cornell. The project (whole) is viewed as a system of several parts (i.e., partners, activities, and initiatives) designed to increase the number of URM students graduating with baccalaureate degrees from KSU over the five years of the project. The goal is to conduct an innovative, comprehensive systems evaluation that will contribute to the literature about recruitment and persistence in STEM post-secondary programs for URMs.

The primary evaluation question for the project is: *What is the impact of the project on STEM pathways in KS among partners in the Alliance?* The two related overall evaluation questions are:

1. How and to what extent do Alliance partner recruitment materials/events and program activities that are designed to increase URM STEM degree program retention rates result in increased STEM interest, STEM identity, sense of belonging, and resiliency of KS-LSAMP student participants? (i.e., what is the impact of KS-LSAMP on student participants?)
2. How and to what extent do the Alliance partner recruitment materials/events and program activities impact the relationships, perspectives, policies/practices and dynamics, within and across partner institutions? (i.e., what is the impact of KS-LSAMP on Alliance partners?)

Each evaluation question has further sub-questions that relate to specific independent and dependent variables, such as students' STEM interest and identity and the summer research immersion program, RIPS, described in the preceding section. The evaluation will seek to answer the questions by evaluating the following project outcomes:

1. Impact of KS-LSAMP on all Alliance partners and student participants;
2. Development of sustained collaborative partnerships among Alliance partners;
3. Appropriateness, relevance and influence of innovative culturally appropriate recruitment materials;
4. Impact of project activities on "cultural competency" and knowledge about URM students by recruiters and advisors (all partners);
5. Impact of the project on successful transfers between Alliance partners and KSU (beyond numbers);
6. Impact of KSU and partner activities and initiatives on student participants; both STEM and non-STEM majors where appropriate;
7. Impact of KSU's summer program and semester research program on student interest in STEM, STEM identity, sense of belonging, etc.

Quantitative project metrics include analysis of data regarding URM student progress through the STEM pathway from enrollment to graduation. For the formative and summative evaluations, the evaluation team examines new and repeated activities to provide feedback for improvement as well as addresses the primary and secondary evaluation questions. Specifically, the purpose of the formative evaluation is to assure continuous project improvement by investigating the impact of various programs and activities within the project. Project staff use formative data to adapt and modify programs and practices to maximize their impact. The purpose of the summative evaluation is to describe the results and impact of the project as a whole on students and institutions.

The evaluation is informed by current research and integrated into all program components. It is built on the project logic model and focuses on project activities, outputs, and outcomes. The evaluation plan provides formative evaluation to assess performance of project activities and provide timely feedback to improve the project, and summative evaluation to assess and document the project outcomes and the impact on students and institutions. Evaluation methods to assess project progress and outcomes include quantitative indicators (e.g., analysis of data regarding URM student enrollment/graduation and tracking students in the STEM Pathway to graduation) and qualitative indicators (e.g., student perceptions related to interest/achievements and faculty perceptions regarding institutional culture and project impacts). Evaluation strategies are also designed to align with the theoretical framework of the project (e.g., social and academic integration, sense of belonging and cultural loyalty, engagement theory).

Evaluation strategies for assessing the project's effectiveness include methods that: utilize multiple evaluation approaches and research methods, draw on both qualitative and quantitative methodologies, and triangulate data for more robust findings where possible. Survey methodology is based on the Dillman Tailored Design Method<sup>33</sup> and focus groups utilize the Krueger and Casey<sup>34</sup> approach for effective qualitative data collection.

As part of the evaluation, the project transition team worked with the college and university institutional research offices to develop a longitudinal tracking system to monitor student progress, especially at critical junctures in the pathway. The tracking system is producing data related to the major student-related goal of the project, to double the number of URM students graduating with degrees in KS-LSAMP majors within the five years of the project and to increase the retention rate for URM students in STEM. Retention is defined as enrollment in STEM after freshman and sophomore years and third year enrollment for transfer students.

### **Research Immersion: Pathways to STEM (RIPS) Preliminary findings**

One of the retention programs of KS-LSAMP is the summer intensive research program, Research Immersion: Pathways to STEM (RIPS). RIPS pairs URM students with faculty research mentors for the duration of the eight-week summer program. Students work with the help and support of their research mentor to conduct a research project and gain experience and skills in the areas of STEM in which they are most interested.

## Methodology

The project staff are studying the impacts of participation in the RIPS program on the interest in STEM education, interest in and commitment to STEM careers, STEM self-efficacy and postsecondary education success efficacy, and future STEM education plans of students in the program. The research utilizes a quasi-experimental design and mixed methodology. Data are collected before and after the summer experience (one group pre-post comparison) and once a year annually for the duration of the project (time series design). Data are collected with an online survey at pre, post, and follow-up intervals. In addition, students are interviewed at the pretest level and take part in a focus group at the end of the summer session.

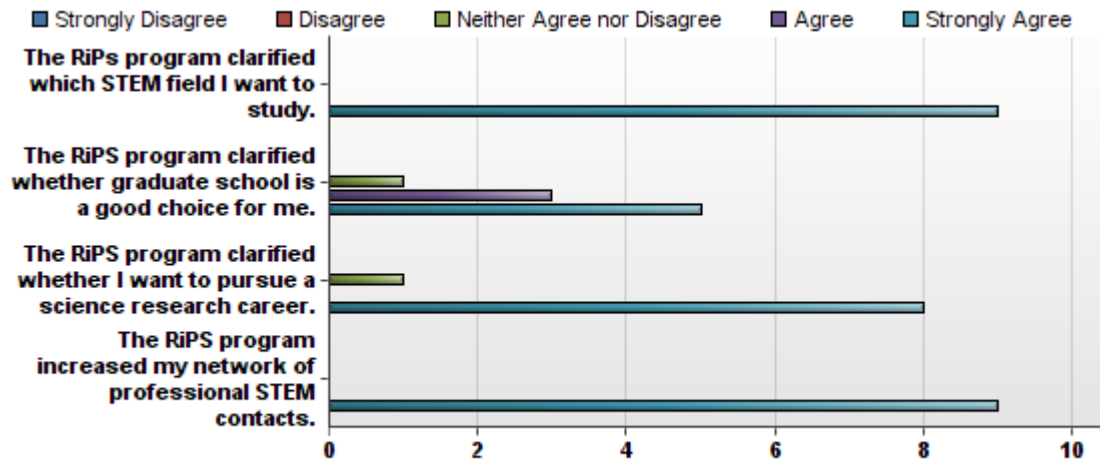
Survey data are analyzed using pre-post comparisons of individual responses and group statistics. Interviews and the focus group are recorded, transcribed and coded for major themes related to the purpose of the research. Follow-up surveys are compared to posttest level surveys and will be compared across years/collections.

## Findings

To date, one summer cohort of students ( $N = 9$ ) have completed RIPS. Students who participated in the first RIPS program responded favorably and enthusiastically to the experience. In a focus group conducted at the conclusion of the summer RIPS program, students expressed that the program was a positive, unique experience that made them want to continue in the STEM field and return to KSU. One respondent commented “This program is probably one of the best things that has happened to me.” This finding is supported by survey results indicating that 100% of students were very satisfied with the RIPS program. Analysis of focus group data demonstrated that nearly every student who took part in the RIPS program could describe at least one prior instance of being discouraged from pursuing interest in a STEM field. Some were discouraged by poor grades and difficulty understanding material. Others faced discrimination based on their immigrant status or struggled with lack of support from family. When asked via an online survey of their level of agreement with the statement, “The RIPS program empowered me to learn more,” every student responded that they strongly agreed with this statement. Additionally, after completing the RIPS program, all nine students reported that they intend to complete a BS degree in a STEM field, compared with only five of nine students indicating they intended to do so prior to taking part in the RIPS program. It appears that the RIPS program fosters resiliency and determination in STEM.

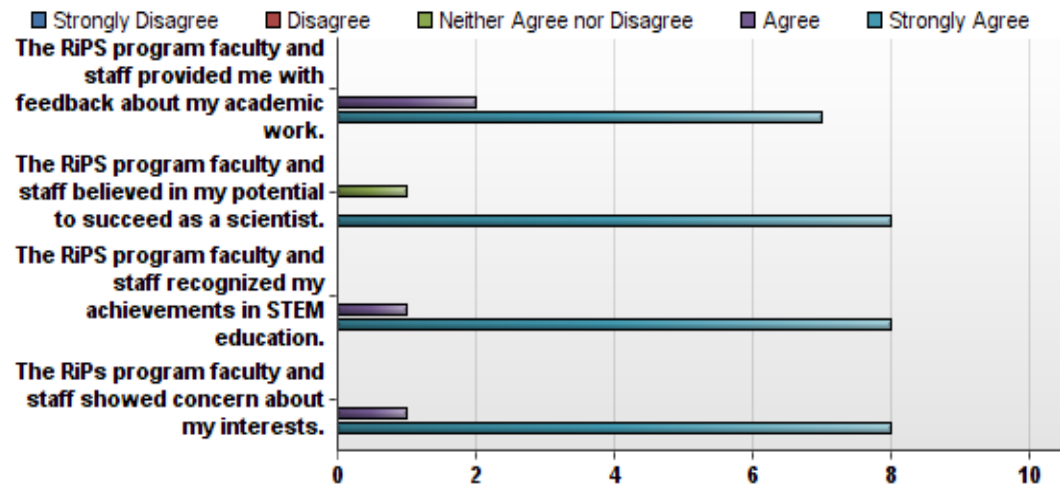
Prior to participating in RIPS, students were asked what they thought it took to be a good scientist. Respondents seemed to have different interpretations of the meaning of the question. As part of the post-participation focus group, respondents were again asked what it took to be a good scientist. The responses seemed to have evolved to the point where there was a general consensus as to what the key elements of a good scientist are. A few themes appeared: self-belief; a great attitude; passion and curiosity; and being able to handle equally well both routine work and unexpected mistakes. The RIPS program was valuable to students in many ways. Figure 1 shows student ratings of possible ways in which students found the RIPS program to be impactful.

Fig. 1. Ratings of program benefits



In focus groups and interviews, the students spoke highly of the RIPS program faculty and staff. RIPS mentors were described as willing to go above and beyond what was expected of them to truly help and make an impact on students. Figure 2 shows student ratings of dispositions and behaviors of the program faculty and staff.

Fig. 2. Ratings of faculty and staff



These data suggest the RIPS program was beneficial to students in a variety of ways. They were able to learn about themselves and their area of study, gain exposure to occupations of interest, and gain a boost in confidence. In summing up the RIPS program experience, one student remarked, “This is a great program. I never thought I would consider going to K-State. The exposure I got in learning about my area of study was extremely helpful in helping me discover the next step in my career and making new friends. I am extremely grateful for this opportunity.”

## Summary

A new Alliance of the Louis Stokes Alliances for Minority Participation has been established in Kansas. The NSF funded KS-LSAMP project, led by Kansas State University in partnership with four minority serving two-year colleges, is designed to increase recruitment and retention of underrepresented minority students in STEM programs of study in order to increase numbers of URM STEM graduates. The Alliance design features a systems approach to management of integrated project components and initiatives that produce a seamless and sustainable pathway for STEM student success and graduation of URM students in the pathway. Evaluation of one new project initiative, the summer intensive research program, Research Immersion: Pathways to Stem, by its first cohort of student participants suggests it was successful in meeting its goals of introducing students to STEM research and reinforcing their interests in STEM fields.

## References

1. President's Council of Advisors on Science and Technology. (2012). *Engage to Excel. Producing One Million Additional College Graduates with Degrees in Science, Technology, Engineering, and Mathematics*. [http://www.whitehouse.gov/sites/default/files/microsites/ostp/pcast-engage-to-excel-final\\_feb.pdf](http://www.whitehouse.gov/sites/default/files/microsites/ostp/pcast-engage-to-excel-final_feb.pdf)
2. National Academy of Sciences (U.S.), Institute of Medicine (U.S.), and National Academy of Engineering. (2011). *Expanding underrepresented minority participating: America's science and technology talent at the crossroads*. Washington, DC: National Academies Press.
3. Hurtado, S., Cabrera, N., Lin, M., Arellano, L., & Espinosa, L. (2009). Diversifying Science: Underrepresented Student Experiences in Structured Research Programs. *Research in Higher Education*, 50, 189–214. DOI: 10.1007/s11162-008-9114-7
4. Clewell, B.C., Cohen, C.C., Tsui, L., & Deterding, N. (2006). *Revitalizing the Nation's Talent Pool in STEM*. Washington DC: The Urban Institute.
5. U.S. Census. <http://quickfacts.census.gov/qfd/states/20000.html>, retrieved 1/27/2015.
6. Kansas State Department of Education. [http://svapp15586.ksde.org/k12/state\\_reports.aspx](http://svapp15586.ksde.org/k12/state_reports.aspx), retrieved 1/27/2015.
7. Kansas State University Planning and Analysis: Student Reports and Historical Information. <http://www.k-state.edu/pa/student/index.html>, retrieved 1/28/2015.
8. National Science Board. (2010). *Preparing the next generation of STEM innovators: Identifying and developing our nation's human capital* (NSB-10-33). Washington, DC: National Science Foundation. Retrieved from [www.nsf.gov/nsb/publications/2010/nsb1033.pdf](http://www.nsf.gov/nsb/publications/2010/nsb1033.pdf)
9. Astin, A.W. (1993). *What matters in college? Four critical years revisited*. San Francisco, CA: Jossey-Bass.
10. Spady, W.G. (1970). Dropouts from higher education: An interdisciplinary review and synthesis. *Interchange*, 1(1), 64–85.

11. Tinto, V. (1975). Dropouts from higher education: A theoretical synthesis of the recent literature. *Review of Educational Research*, 45(1), 89–125.
12. Tinto, V. (1997). Colleges as communities: Exploring the educational character of student persistence. *Journal of Higher Education*, 68, 599–623.
13. Nora, A. (2003). Access to higher education for Hispanic students: Real or illusory? In J. Castellanos & L. Jones (Eds.), *The majority in the minority: Expanding the representation of Latina/o faculty, administrators, and students in higher education* (pp. 47–70). Sterling, VA: Stylus Publishing.
14. Nora, A., Barlow, E., & Crisp, G. (2005). Student persistence and degree attainment beyond the first year in college: The need for research. In A. Seidman (Ed.), *College student retention: Formula for student success* (pp. 130–153). Westport, CT: Praeger.
15. Alva, S.A. (1991). Academic invulnerability among Mexican-American students: The importance of protective resources and appraisals. *Hispanic Journal of Behavioral Sciences*, 13, 18–34.
16. Gonzalez, R., & Padilla, A. (1997). The academic resilience of Mexican American high school students. *Hispanic Journal of Behavioral Sciences*, 19(3), 301–317.
17. Astin, A. W. (1982). *Minorities in American higher education: Recent trends, current prospects, and recommendations*. San Francisco, CA: Jossey-Bass.
18. Sedlacek, W. (1989). Noncognitive indicators of student success. *Journal of College Admissions*, 125, 2–10.
19. Hernandez, J. C., & Lopez, M. A. (2004). Leaking pipeline: Issues impacting Latino/a college student retention. *Journal of College Student Retention*, 6(1), 37–60.
20. Chang, M. J., Eagan, M. K., Lin, M. H., & Hurtado, S. (2011). Considering the impact of racial stigmas and science identity: Persistence among biomedical and behavioral science aspirants. *Journal of Higher Education*, 82(5), 564–596.
21. Carlone, H. B., & Johnson, A. (2007). Understanding the science experience of successful women of color: Science identity as an analytic lens. *Journal of Research in Science Teaching*, 44(8), 1187–1218.
22. Sabatini, D. A. (1997). Teaching and research synergism: The undergraduate research experience. *Journal of Professional Issues in Engineering Education and Practice*, 123(3), 98–102.
23. Lopatto, D. (2003). The essential features of undergraduate research. *Council on Undergraduate Research Quarterly*, 2, 139–142.
24. Mabrouk, P. A., & Peters, K. (2000). Student perspectives on undergraduate research (UR) experiences in chemistry and biology. Paper presented at The Role and Nature of Research by Undergraduates in Chemistry: An on-line conference April 3 - May 5, 2000.  
<http://www.chem.vt.edu/confchem/2000/a/mabrouk/mabrouk.htm>.
25. Kearsley, G. (1997). *The Virtual Professor: A Personal Case Study*. Retrieved 2012, from <http://home.sprynet.com/~gkearsley/virtual.html>
26. Kearsley, G., & Shneiderman, B. (1998). Engagement theory: A framework for Technology-Based Teaching and Learning. *Educational Technology*, 38(5), 20–23.
27. Davis, C. G., & Finelli, C. J. (2007). Diversity and retention in engineering. *New Directions for Teaching and Learning*, 111, 63–71.



28. DiPrete, T. A., Eirich, G. M. (2006). Cumulative advantage as a mechanism for inequality: A review of theoretical and empirical developments. *Annual Review of Sociology*, 32, 271–297.
29. Duffy, T.M. & Jonassen, D. (Eds.). (1992). *Constructivism and the technology of instruction: A conversation*. Hillsdale NJ: Lawrence Erlbaum Associates.
30. Vygotsky, L.S. (1978). *Mind in society: The development of higher mental processes*. Cambridge, MA: Harvard University Press.
31. Vance, M. L., & Miller, W. K. (2009). Serving wounded warriors: Current practices in postsecondary education. *Journal of Postsecondary Education and Disability*, 22(1), 199–216.
32. Cornell Office for Research on Evaluation (2010). *Systems Evaluation Protocol*. <https://core.human.cornell.edu/documents/TheProtocol.pdf>. Retrieved 1/30/15.
33. Dillman, D. A., Smyth, J. D., & Christian, L. M. (2009). *Internet, mail, and mixed-mode surveys: The tailored design method*. Hoboken, N.J: Wiley & Sons.
34. Krueger, R. A., & Casey, M. A. (2009). *Focus groups: A practical guide for applied research*. Los Angeles CA: SAGE.
35. Gharajedaghi, J. (2011). *Systems thinking, third edition: Managing chaos and complexity: A platform for designing business architecture*. Burlington, MA: Morgan Kaufman.