Biology, Program Review, Section 1

Summary Statement about the State of the Program

# Mid-America Christian University Biology Program Chair's Summary about the State of the Program

A Brief History of Mid-America University as stated in the University Catalog:

**Mission Statement** 

Mid-America Christian University prepares students through a Wesleyan perspective to create, collaborate, and innovate to solve local and global problems for the glory of God through Jesus Christ and the good of society.

This mission statement reflects MACU's stable, historical philosophy of education in the enduring identity and heritage of the University. This mission guides all the purposes, goals, and activities of the University. The mission and purposes of Mid-America Christian University affirm the basic goal to equip men and women for effective Christian ministry, providing that a person does not have to be a pastor or a missionary to have a ministry.

All Christians are called to serve Christ and minister to others. Many graduates exercise this responsibility as pastors and full-time church ministers, but others are called to serve as musicians, teachers, counselors, or in other ways. The mission statement is congruent with the objectives and purposes of the institution. It continues to be evident in practical application.

# Vision Verse

"Very truly I tell you, whoever believes in me will do the works I have been doing, and they will do even greater things than these, because I am going to the Father." (John 14:12)

## Vision Statement

Mid-America Christian University is "Preparing People to do Greater Things for God and His Kingdom" Dream Bigger. Do Greater.

# History of the University

Chartered by the state of Texas and recognized as an institution of higher education, South Texas Bible Institute opened on September 14, 1953 in Houston, Texas. Under the leadership of Dr. Max R. Gaulke, the institute's founder and president, the institute used the facilities of the First Church of God and began its first class with 26 students.

In the fall of 1955, the curriculum was expanded to that of a four-year college and the name was changed to Gulf-Coast Bible College. In 1966, Gulf-Coast Bible College became an associate member of the American Association of Bible Colleges and was granted full membership in 1968. Ten years later, it was granted full accreditation by the Southern Association of Colleges and Schools.

In June of 1968, Gulf-Coast Bible College became a general agency of the Church of God, Anderson, Indiana. As a result of the action by the General Assembly, the College was granted representation on the Executive Council of the Church of God and full membership on the Commission on Higher Education of the Church of God. In the summer of 1985, Gulf- Coast Bible College moved to Oklahoma City, Oklahoma, and became Mid-America Bible College. Moving to Oklahoma City placed the college under a new regional accreditation body, the Higher Learning Commission of the North Central Association of Colleges and Schools. In 2003, the college became Mid-America Christian University. Since its inception, the University has been led by four distinguished presidents: Dr. Gaulke, the University's founder (1953 – 1975); Dr. John W. Conley (1975 – 1989); Dr. Forrest Robinson (1989 –

1999); and Dr. John D. Fozard (1999 - present).

# Mid-America Christian University Biology Program

The mission of Mid-America Christian University's (MACU) Bachelor of Science biology program is to provide students with ample in-depth learning opportunities in biology as well as other courses related to biology, such as mathematics and chemistry. Our students are exposed to critical analysis of real-world issues, scientific methodology to discover interrelationships with other disciplines, and opportunities for effective communication within the academic community.

Students at MACU who are majoring in biology or a multidisciplinary biology program will be prepared to enter professional degree programs, such as medicine, nursing, dentistry, veterinary, education, physical therapy, research, and various other graduate programs. MACU's biology curriculum may also lead to careers in sports science, pharmacy, psychology, chemistry, and environmental science. Additionally, the biology program at MACU will assist pre-service teachers majoring in education by allowing teachers' access to science content while considering age appropriate science curriculum development.

MACU believes that preparing students for success in a biology program requires an abundant opportunity for mentorships with faculty and other students. MACU offers small classroom sizes and access to the faculty throughout the school semester and beyond. Our biology program will also give MACU opportunities to develop bridge programs for students to various colleges and universities, professional programs and internships with local organizations. It is the goal of MACU to have a high acceptance and employment rate for graduating students entering professional schools, graduate programs, or the workforce.

All biology majors are required to complete 46 hours in MACU university core courses, 69-71 hours in biology with 40 hours in upper division, 6-7 hours of electives related to their degree, and 1 hour of orientation. A unique course embedded in a student's requirement is BIOL 4501 Biology Research, all students must take this course during their junior and senior year. BIOL 4501 introduces students to critical analysis of peer-reviewed scientific research, additionally students are required to create a working Curriculum Vitae as a final assessment piece.

The biology program is interested in building partnerships with other universities in Oklahoma. In 2020 MACU's biology program entered two partnerships, the first is a nursing school matriculation to Oklahoma City University's Kramer School of Nursing, and the second is a 3+1 program with the Oklahoma State University Medical School. The first partnership will allow students a seamless transfer to OKCU nursing school pending the student meets all their requirements. The OSU partnership is a 3+1, which will allow students who meet requirements set forth by OSU/MACU to take their senior year at OSU's Health Science Center this will be considered their first year of medical school, thus reducing their schooling from 8 year to 7 years. For the OSU 3+1 program MACU students will still be considered graduates of MACU.

Pursuing additional outside funding has been a priority for MACU's biology program. The current Chair of the program secured \$20,000.00 (contribution made by the Otoe-Missouria Tribe of Oklahoma) during the program's inaugural year, this money catapulted the program ahead and supplied lab materials for all the courses offered during the first 3 years of the program. In 2019 the biology program also laid the groundwork to secure a USDA grant -

Access to Online Math and Science (ATOMS), by partnering with MACU's School of Education and rural school districts in Oklahoma. Below is a list of other grants pursued by the biology program:

- National Science Foundation S-STEM: Co-Curricular Activities Promoting Scholarship in Mathematics and Science (CAPS)
- National Science Foundation Improving Undergraduate STEM Education (IUSE) Institutional and Community Transformation Track: Faculty and Institutional Accelerated Transformation (FIAT)
- National Science Foundation Robert Noyce Teacher Scholarship Program: Scholarships for Underrepresented Groups in Education (SURGE)
- National Science Foundation Scholarships in STEM: Technology for Engaging Environments in Mathematics and Science (TEEMS)
- National Science Foundation Advancing Informal STEM Learning: Science and Math Interactive Learning Environment (SMILE)
- United States Department of Agriculture: College-Level Education for Rural Schools (CLEARS)
- National Science Foundation: Integrating Science, Mathematics and Education (ISME)

The number of students majoring in biology has grown each year since the beginning of the biology program in 2016. The current number of registered students in the program is 42. In the past 2 years the program has successfully graduated 10 students. In 2019, the biology program's first graduate entered a PhD program at the University of Arkansas. The program's second graduate entered a doctoral program for Physical Therapy in Tennessee. The remaining 8 graduates have a variety of different goals: One student is working in a science lab in Oklahoma City, OK and is pursuing a job with the Oklahoma State Bureau of Investigation. One student is working at the University of Oklahoma Health Science Center lab and is applying to graduate school. Several students have applied to medical school and are currently working for medical centers to shadow physicians. There are two other students who took biology courses to pursue a nursing profession yet majored in a different area of study (started at MACU before the biology program was established). One is currently working as a registered nurse at the Oklahoma Heart Hospital, and one is currently enrolled at the University of Oklahoma nursing school. Other graduates are currently applying for graduate schools or entering the workforce.

The following list of people and schools have been invaluable in assisting our program's growth and consistency, and are worth mentioning, each has played an integral role through advisement and consultation, accommodating our students on their campus, and supplying our science laboratories:

- Oklahoma School of Science and Math
- Otoe-Missouria Tribe of Oklahoma
- Dr. Steven Shore, Oklahoma City Community College Chemistry Department
- Phillip Drummond M.S., Central Community College Nebraska Microbiology Department
- Dr. Ruben Ceballos, University of Arkansas Biology Department
- Dr. Edwin Vineyard, Northern Oklahoma College VPAA

- Dr. Kerry Magruder, University of Oklahoma Curator, History of Science Collections
- Keller Partners & Company, Washington D.C.
- Becky Kriewell, Account Manager at VWR/Ward's Scientific
- Dr. Kent Smith, Oklahoma State College of Osteopathic Medicine
- JuLee Wells, Oklahoma State College of Osteopathic Medicine
- Shirley McBay, Quality Education for Minorities Network

The following individuals have contributed by teaching within the school of Science as a fulltime faculty member or part-time instructor or lab/office personnel. They all played a key role in the success of the biology program:

- Harold Kihega, Ph.D. (Biology)
- Deshani Fernando, Ph.D. (Chemistry)
- Brent Raisley, Ph.D. (Biology)
- Carol Fowlkes, Ph.D. (Mathematics)
- Joann Kihega, M.S. (Chemistry)
- Laura Christian, M.S. (Biology)
- Kendra Christian, B.S. (Biology Lab Personnel)
- Wayne Glasco, D.C.M (Biology)
- Brittney Stephens, B.S. (Biology Lab Personnel)
- Nevada Denton, B.S. (Biology Lab Personnel)
- Jillian Cox, A.S. (Biology Office and Tutor)
- Krystal Huffaker, B.S. (Biology/Chemistry Lab Personnel)
- Morgan Rom, M.S. (Biology)
- Rahmat Rahmat, Ph.D. (Physics)
- Greg Nelson, M.S. (Physics)

In 2020 Dr. Kihega and Dr. Fernando attended the Annual Course Equivalency Project (CEP) meeting with Oklahoma higher education institutions to advance the biology program's validity. For the biology department 9 of the 10 courses were approved (Biology I, Biology II, General Botany, Microbiology, Human Anatomy, Human Anatomy and Physiology, General Zoology, Genetics) for inclusion to the transfer matrix. The course that did not make the matrix needs to incorporate a laboratory component (cell biology). Chemistry courses need to add a recitation component to the syllabus for approval by the CEP committee.

Future ambitions for the biology program are to continue grooming our partnerships with K-12 schools and matriculation agreements with other state higher education institutions. As our school continues to grow, we are researching adding an additional laboratory room for a total of 3 labs on campus. This will allow the enhancement of the cell biology course and teaching effectiveness of the science department, as well as provide additional rigor for the majors, prenurses, and OSU 3+1 students. We also plan to hold independent laboratories for students who may have scheduling conflicts from either a required course held at the same time or student sponsored events. It is also a goal to incorporate more technology in the classroom and laboratories to enhance student learning outcomes. Our current program outcomes are listed below:

- **Program Outcome 1: Effectively Communicate Core Science Concepts -** Student Learning Outcome 1.1 Organize scientific data and effectively present through tables, charts, and images, Student Learning Outcome 1.2 Critique and Summarize current research topics
- **Program Outcome 2: Apply Quantitative and Qualitative Analysis to Interpret Scientific Data -** Student Learning Outcome 2.1 Draw conclusions based on appropriate research protocol, Student Learning Outcome 2.2 Classify organisms according to quantitative and qualitative processes
- **Program Outcome 3: Understand the Relationship of Core Concepts Across Various Disciplines -** Student Learning Outcome 3.1 Apply chemistry, physics, mathematics, and biology content to explain the natural world, Student Learning Outcome 3.2 Effectively collaborate across disciplines
- Program Outcome 4: Implement Correct Laboratory Methodology to Assess Diverse Scientific Systems - Student Learning Outcome 4.1 Accurately perform laboratory protocol, Student Learning Outcome 4.2 Utilize laboratory equipment correctly and safely

Biology, Program Review, Section 2

Program Sheet from Catalog

#### Biology, B.S.

Effective: 1-1-

2019

The biology program at MACU provides students with a strong foundation to enter multiple science careers; STEM graduate schools and professional health science programs. In addition to classroom and laboratory teaching modules, MACU provides abundant opportunities for faculty-to-student mentorships, peer-to peer collaborative learning, and critical thinking opportunities related to science research protocol. Choose 14-15 hours of biology elect BIOL 1013 Medical Terminology\*\* BIOL 3333 Cell Biology BIOL 3363 Evolution BIOL 3404 Ecology BIOL 4124 Histology

#### **University Core**

Specific courses within the University Core are listed on the first page of this catalog section. University Core (46 Hrs) Bible/Theology (12 hrs) Communication (9 hrs) U.S. History and Government (6 hrs) Science (7 hrs) \*NATS 2101 Environmental Science Lab \*NATS 2103 Environmental Science Math (3 hrs) \*MATH 1513 College Algebra Social Sciences (3 hrs) \*PSYC 1103 Intro to Psychology Humanities (6 hrs – 3 must be literature)

\*These courses are required pre-requisites for the major. Upon completion of the above courses, corresponding University Core requirements will be satisfied. (These courses are required for this major regardless of previous degrees conferred). See the Academic Program Requirements section of this Catalog for additional requirements.

**Orientation (1 hr)** UNIV 1121 First Year Evangel

#### **Major Requirements**

**Biology Major (55-56 hrs)** BIOL 1214 Biology I BIOL 1314 Biology II **BIOL 2114 General Zoology** BIOL 2214 General Botany BIOL 2314 Anatomy and Physiology I and BIOL 2324 Anatomy and Physiology II OR BIOL 3114 Human Anatomy\*\* and BIOL 3214 Human Physiology\*\* BIOL 3305 Microbiology\*\* **BIOL 4501 Biology Research** CHEM 1105 Chemistry I CHEM 1205 Chemistry II CHEM 3103 Organic Chemistry I CHEM 3102 Organic Chemistry I Lab MATH 2114 Calculus 1 or MATH 4113 Mathematical Modeling\*\* MATH 3703 Introduction to Statistics PHYS 1134 General Physics I (with Lab) or PHYS 2104 Physics I (with Lab)

#### **Biology Major Electives (14-15 hrs)**

Choose 14-15 hours of biology electives from this list. BIOL 1013 Medical Terminology\*\* BIOL 3333 Cell Biology BIOL 3354 Genetics BIOL 3363 Evolution BIOL 3404 Ecology BIOL 4124 Histology BIOL 4124 Histology BIOL 4144 Plant Taxonomy BIOL 4213 History of Science BIOL 4314 Embryology\*\* BIOL 4901 Special Topics in Biology\*\* CHEM 3123 Principles of Biochemistry\*\* CHEM 3203 Organic Chemistry II\*\* CHEM 3202 Organic Chemistry II Lab\*\*

#### General Electives\*\* (6-7 Hrs)

Choose 6 hours of electives. The following are not required but recommended: BIOL 1133 General Nutrition PHYS 1234 General Physics II (with Lab) PSYC 3813 Cognitive Psychology PSYC 4213 Physiological Psychology and Neuroscience PSYC 4703 Psychology of Abnormal Behavior

Students must have a minimum of 40 hours of 3000 and 4000 level courses in order to receive a bachelor's degree. Please note: This may require the student to take up to ten (10 Hrs) of upper division elective hours in order to meet this graduation requirement.

\*\* Biology major students may choose to replace a combination of the Biology major electives/General Electives with a Multidisciplinary option. (See Multidisciplinary options at the beginning of the Academic Degree program section).

Total University Core 46 Total Orientation 1 Total Biology Major 55-56 Total Biology Major Electives 14-15 <u>Total Electives 6-7</u> Total Required Hours 122-125

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## **Multidisciplinary Options**

#### **Multidisciplinary Options**

o Biology

Multidisciplinary options allow a unique opportunity for students interested in more than one academic discipline to choose a primary program and a secondary discipline of study. The courses required in the secondary discipline will be taken in lieu of the primary program's electives. At the time the student designates the primary and secondary multidisciplinary course of study, they must be approved by the chairpersons of the two academic disciplines.

- When a Multidisciplinary course of study is requested, it <u>must be approved by both chairpersons</u> of each discipline.
- Additional electives may be required to meet the minimum degree requirements
- Degree Programs Multidisciplinary options are available with the degree programs listed below:
  - Studies
  - o Business Administration and Ethics o Management and Ethics o
    - o Communication, Media, and Ethics Mathematics
    - English, Literary and Cultural Ministry Leadership Psychology

#### One of the following Multidisciplinary focus areas may be added to any one of the above listed Degree Programs.

#### **Biology (34-37 Hrs)**

Cellular (36 Hrs)

Choose one focus area: Cellular, Human, or Organismal

BIOL 1214 Biology I	<b>Business Administration (30 Hrs)</b>	Organismal (34-35 Hrs)
BIOL 1314 Biology II	BIOL 1314 Biology II	BIOL 1214 Biology I
BIOL 3305 Microbiology	BIOL 3305 Microbiology	BIOL 1314 Biology II
CHEM 1105 Chemistry I	CHEM 1105 Chemistry I	CHEM 1105 Chemistry I CHEM 1205
CHEM 1205 Chemistry II	CHEM 1205 Chemistry II	Chemistry II BIOL 3214 Human
CHEM 3103 Organic Chemistry I	BIOL 4124 Histology	Physiology BIOL 4144 Plant Taxonomy
CHEM 3102 Organic Chemistry I Lab	BIOL 4501 Biology Research	BIOL 4501 Biology Research
BIOL 3333 Cell Biology	Anatomy Options	Organismal Options
BIOL 3354 Genetics	BIOL 2314 Anatomy and Physiology I	BIOL 2114 General Zoology or BIOL
BIOL 4501 Biology Research	and BIOL 2324 Anatomy and	2214 General Botany AND
	Physiology II <b>OR</b>	BIOL 3363 Evolution or BIOL 3404
Human (36 Hrs)	BIOL 3114 Human Anatomy and BIOL	Ecology
BIOL 1214 Biology I	3214 Human Physiology	

This option is not available with the Management and Ethics plan of studyACCN 2103 Principles of Financial Accounting ACCNECON 2503 Survey of Economics2203 Principles of Managerial Accounting BUAD 2503MGMT 3213 Applied Business ManagementBusiness and Professional Communication BUAD 3403MKTG 3103 Principles of MarketingBusiness FinanceSelect 6 additional hours from other courses within theBUAD 4303 Human Resource Administrationdiscipline.

#### **Communication and Media (30 Hrs)**

COMM 2113 Media Culture and Social Influence Select 12 additional hours from other courses within the COMM 2143 Digital Media Literacy discipline: COMM 2803 Writing for Mass and Social Media COMM 2123 Introduction to Computer Mediated COMM 3533 Public Relations, Advertising, and Brand Communication Management COMM 3213 Organizational and Professional Communication COMM 4603 Creating Social Media Presence and Cultural COMM 3233 Media Law and Ethics COMM 3433 Media Studies in Research and Design Movements COMM 4803 Media Studies, Public Relations, Social Media COMM 3903 Integrated Marketing and Public Relations COMM 4103 Special Topics in Media Studies Capstone COMM 4413 Communication and Cultural Change

## **ACADEMIC SUPPORT**

#### Academic Advisement

## College of Arts and Sciences: Faculty Academic Advisor

To assist students in their academic pursuits, the registrar assigns each student in the College of Arts and Sciences a faculty academic advisor based upon the student's major. The faculty academic advisor is available to assist students with academic, social, and spiritual concerns, and is vital in mentoring and making sure students steadily progress toward degree completion and success in the program.

#### College of Adult and Graduate Studies: Faculty Academic Advisor

Adult and graduate students pursuing their studies in the College of Adult and Graduate Studies are assigned a faculty academic advisor to assist them with academic, social and spiritual concerns throughout their program of study. In some cases, time management can be difficult when juggling school, work and personal life; a Student Support Specialist plays a vital role in mentoring and helping adult and graduate students prioritize and steadily progress through their studies toward degree completion and success in the program. Faculty, program directors, and school chairs assist learners with academic advising.

## Pre-Professional Academic Advisement

Whether you are considering a career in law, medicine, or health MACU has academic advisement for each area. This advisement offers suggestions for helpful classes, specific courses, prerequisites, and general information about respective programs. The pre-professional advisement will not advise you regarding specific classes that you need to take for a specific major but will offer information about application to a professional school, the admission process, writing personal statements, etc. For semester-to-semester advising for your major plan of study, students need to visit with the academic advisor in their degree-granting college for admissions requirements specific for that institution.

#### Focus

- Select a major you will enjoy and be happy with, even if you do not go to the graduate school or in case there is a gap between college and graduate school.
- · Be bold in choosing your major. There is no one-size-fits-all major for most graduate school. ·

Discuss your interests with your advisor.

#### **Pre-Dental Advising**

#### IMPORTANT FACTORS FOR ADMISSIONS TO DENTAL SCHOOL:

· Undergraduate degree in science recommended but	$\cdot$ Dental Admissions Test (DAT) Score $\cdot$ Letters of
not required	Recommendation
$\cdot$ Undergraduate Grade Point Average of 2.5 or higher	· Personal Statement/Interview

 $\cdot$  Resume –experience shadowing in a dental office

#### PRE-DENTAL RECOMMENDED COURSES

CHEM 3203 Organic Chemistry I
CHEM 3202 Organic Chemistry II lab MATH 2114
Calculus I and Analytic Geometry PHYS 2104
Physics I (with lab)
PHYS 2204 Physics II (with lab)

#### **Pre-Law Advising**

The American Bar Association (ABA) does not recommend any undergraduate majors or group of courses to prepare for a legal education. Students are admitted to law school from almost every academic discipline. You may choose to major in subjects that are considered to be traditional preparation for law school, such as history, English, philosophy, political science, economics or business, or you may focus your undergraduate studies in areas as diverse as art, music, science and mathematics, computer science, engineering, nursing or education. Whatever major you select, you are encouraged to pursue an area of study that interests and challenges you, while taking advantage of opportunities to develop your research

and writing skills. Taking a broad range of difficult courses from demanding instructors is excellent preparation for legal education. A sound legal education will build upon and further refine the skills, values, and knowledge that you already possess.

#### IMPORTANT FACTORS FOR ADMISSIONS TO LAW SCHOOL:

· Undergraduate Grade Point Average · Law School Admission Test (LSAT) Score · Resume

#### **PRE-LAW RECOMMENDED COURSES**

ACCN 4623 Accounting Legal Environment BUAD 4103 Legal Environment of Business BUAD 4403 Church and Nonprofit Finances COMM 3233 Media Law and Ethics CRJS 3303 Criminal Justice Philosophy and Practice CRJS 3503 Criminal Law I CRJS 3513 Criminal Law II ECON 2503 Survey of Economics ENGL 3503 Advanced Composition ENGL 3703 Creative Writing ENGL 4203 Modern Grammar

· Letters of Recommendation · Personal Statement

ENGL4303 Shakespeare ENGL 4333 The Fiction Works of C.S. Lewis ENGL 4353 The Apologetics Works of C.S. Lewis ENGL 4503 History of the English Language ENGL 4533 Critical Approaches to Literature HC 3503 Legal Aspects of Health Care Management HIST 4103 Colonial Period HIST 4203 19th Century United HIST 4213 Twentieth Century United States History HIST 4323 Directed Readings in US History PHIL 3203 Making of the Modern Mind PMIN 4233 Nonprofit and American Church Law

#### **Pre-Med Advising**

#### IMPORTANT FACTORS FOR ADMISSIONS TO MED SCHOOL:

· Undergraduate degree in any major, but science or psychology is preferred ·

Undergraduate Grade Point Average of 3.0 or higher

- · Graduate Record Examination (GRE) Score
- · Letters of Recommendation

#### **PRE-MED COURSES**

CHEM 1105 Chemistry I

BIOL 1133 General Nutrition	CHEM 1205 Chemistry II
BIOL 1214 Biology I	CHEM 3123 Principles of Biochemistry
BIOL 1314 Biology II	CHEM 3103 Organic Chemistry I
BIOL 3114 Human Anatomy	CHEM 3102 Organic Chemistry I Lab
BIOL 3214 Human Physiology BIOL 3305	CHEM 3203 Organic Chemistry II
Microbiology	CHEM 3202 Organic Chemistry II Lab
BIOL 3333 Cell Biology <u>or</u>	MATH 2114 Calculus I & amp; Analytic Geometry
BIOL 3354 Genetics	MATH 3703 Introduction to Statistics
BIOL 4314 Embryology	PHYS 2104 Physics I (with Lab)
BIOL 4124 Histology	PHYS 2204 Physics II (with lab)
BIOL 4501 Biology Research	PSYC 4703 Psychology of Abnormal Behavior
CHEM 3123 Principles of Biochemistry	

#### **Pre-Nursing Advising**

Mid-America Christian University and Oklahoma City University (OCU) have participated in articulated transfer agreements for the success and degree completion of students with an avenue to earn a Bachelor of Science in Nursing (BSN). For transfer requirements to OCU see the General Studies Pre-Nursing Track.

#### **IMPORTANT FACTORS FOR ADMISSIONS TO NURSING SCHOOL:**

- · Undergraduate associate degree
- · Undergraduate Grade Point Average

**PRE-NURSING COURSES** BIOL 1214 Biology I BIOL 1314 Biology II Mid-America Christian University Catalog 2020-2021 July 15, 2020

BIOL 2314 Anatomy and Physiology I or BIOL 3114 Human Anatomy and BIOL 2324 Anatomy and Physiology II or BIOL 3214 Human Physiology **BIOL 3305 Microbiology** CHEM 1105 Chemistry I PSYC 1103 Introduction to Psychology

## **Pre-Occupational Therapy Advising**

#### IMPORTANT FACTORS FOR ADMISSIONS TO OCCUPATIONAL THERAPY SCHOOL:

· Undergraduate degree in any major, but science or psychology is preferred ·

Undergraduate Grade Point Average of 3.0 or higher

 $\cdot$  Resume – 40 hours of observation experience in an occupational therapy environment  $\cdot$ Graduate Record Examination (GRE) Score

**PRE-OCCUPATIONAL THERAPY COURSES** 

BIOL 1013 Medical Terminology BIOL 1214 Biology PSYC 3303 Development Across the Lifespan I BIOL 3114 Human Anatomy BIOL 3214 Human Physiology CHEM 1105 Chemistry I MATH 3703 Introduction to Statistics PHYS 2104 Physics I (with Lab)

PSYC 4703 Psychology of Abnormal Behavior SOCI 2243 Introduction to Cultural Anthropology Pre-

#### **Optometry Advising**

#### **IMPORTANT FACTORS FOR ADMISSIONS TO OPTOMETRY SCHOOL:**

· Undergraduate degree in any major, but science is preferred Undergraduate Grade Point Average of 2.5 or higher

 $\cdot$  Resume – 40 hours of observation experience in an optometry office

#### **PRE-OPTOMETRY COURSES**

BIOL 3114 Human Anatomy BIOL 3214 Human MATH 2114 Calculus I and Analytic Geometry Physiology BIOL 3305 Microbiology MATH 3703 Introduction to Statistics CHEM 3103 Organic Chemistry I CHEM 3102 PHYS 2104 Physics I (with Lab) Organic Chemistry I lab CHEM 3203 Organic PSYC 4703 Psychology of Abnormal Behavior Chemistry I CHEM 3202 Organic Chemistry II lab **Pre-Pharmacy Advising** 

CHEM 3123 Principles of Biochemistry

**IMPORTANT FACTORS FOR ADMISSIONS TO PHARMACY SCHOOL:** 

· Undergraduate Grade Point Average of 2.5 or higher

#### **PRE-PHARMACY RECOMMENDED COURSES**

BIOL 1214 Biology I **BIOL 1314 Biology II** BIOL 3305 Microbiology CHEM 1105 Chemistry I CHEM 1205 Chemistry II CHEM 3103 Organic Chemistry I CHEM 3102 Organic Chemistry I lab CHEM 3203 Organic Chemistry I

CHEM 3202 Organic Chemistry II lab MATH 2114 Calculus I and Analytic Geometry PHYS 2104 Physics I (with Lab)

## **Pre-Physical Therapy Advising**

### IMPORTANT FACTORS FOR ADMISSIONS TO PHYSICAL THERAPY SCHOOL:

Undergraduate degree in any major, but science or psychology is preferred .

Undergraduate Grade Point Average of 2.5 or higher

· Graduate Record Examination (GRE) Score

· Letters of Recommendation

60 Mid-America Christian University Catalog 2020-2021 July 15, 2020 **Biology** I BIOL 1314 Biology II **PRE-PHYSICAL THERAPY COURSES BIOL 1214** 

BIOL 3114 Human Anatomy BIOL 3214 Human Physiology CHEM 1105 Chemistry I PHYS 2104 Physics I (with Lab) PHYS 2204 Physics II (with lab) PSYC 4703 Psychology of Abnormal Behavior

CHEM 1205 Chemistry II

MATH 3703 Introduction to Statistics

## **Pre-Physician Assistant Advising**

#### IMPORTANT FACTORS FOR ADMISSIONS TO PHYSICIAN ASSISTANT SCHOOL:

Undergraduate degree in any major, but science or psychology is preferred · Undergraduate Grade Point Average of 3.0 or higher · Graduate Record Examination (GRE) Score

Graduate Record Examination (GRE) Seo

· Letters of Recommendation

#### **PRE-PHYSICIAN ASSISTANT COURSES**

BIOL 1133 General Nutrition	CHEM 1205 Chemistry II
BIOL 1214 Biology I	CHEM 3123 Principles of Biochemistry
BIOL 1314 Biology II	CHEM 3103 Organic Chemistry I
BIOL 3114 Human Anatomy	CHEM 3102 Organic Chemistry I Lab
BIOL 3214 Human Physiology BIOL 3305	CHEM 3203 Organic Chemistry II
Microbiology	CHEM 3202 Organic Chemistry II Lab
BIOL 3333 Cell Biology or	MATH 2114 Calculus I & amp; Analytic Geometry
BIOL 3354 Genetics	MATH 3703 Introduction to Statistics
BIOL 4314 Embryology	PHYS 2104 Physics I (with Lab)
BIOL 4124 Histology	PHYS 2204 Physics II (with lab)
BIOL 4501 Biology Research	PSYC 4703 Psychology of Abnormal Behavior
CHEM 3123 Principles of Biochemistry	

CHEM 1105 Chemistry I

**Pre-Veterinary Medicine Advising** 

#### IMPORTANT FACTORS FOR ADMISSIONS TO VETERINARY MEDICINE SCHOOL:

Undergraduate degree in any major, but science or psychology is preferred · Undergraduate Grade Point Average of 2.5 or higher · Medical College Admission Test (MCAT) or Graduate Record Examination (GRE) Score · Resume – 40 hours of observation experience working with animals · Letters of Recommendation

#### **PRE-VETERINARY MEDICINE COURSES**

Animal Nutrition
BIOL 1214 Biology I
BIOL 1314 Biology II
BIOL 2114 General Zoology
BIOL 3305 Microbiology
BIOL 3354 Genetics
BIOL 4124 Histology
CHEM 3123 Principles of Biochemistry
CHEM 1105 Chemistry I

CHEM 1205 Chemistry II CHEM 3103 Organic Chemistry I CHEM 3102 Organic Chemistry I Lab CHEM 3203 Organic Chemistry II CHEM 3202 Organic Chemistry II Lab PHYS 2104 Physics I (with Lab) PHYS 2204 Physics II (with lab) PSYC 4703 Psychology of Abnormal Behavior <u>or</u> SOCI 2243 Introduction to Cultural Anthropology

## Non-Collegiate Learning Test Center

The test center at Mid-America Christian University is an open test center for <u>CLEP</u>, <u>DSST</u>, and <u>MAT</u> (<u>Miller's Analogy</u> <u>Test</u>) tests. Testing Services are available each Wednesday and Friday afternoon. The test center also proctors placement exams and diagnostic exams. For reservations or other testing questions, call 405.692.3103 or email <u>testcenter@macu.edu</u>.

Biology, Program Review, Section 3

Strategic Plans and Budgets Related to Program (most recent SPUN)

### Mid America Christian University Biology Program 3-year forecast

#### Introduction

Over the past few months, students interested in pursuing a biology degree have increased considerably at Mid America Christian University (MACU). According to the MACU Recruitment Office, 361 contacts for the fall 2017 semester indicated interest in careers that require biology curriculum as a foundation.

#### Demand

Careers related to a biology degree are too numerous to list, this is a partial list: medical doctor, nurse, pharmacist, dentist, physician's assistant, occupational therapy, physical therapy, environmental scientist, veterinarian, emergency medical technician, wildlife biologist, teachers at all levels of school, radiation therapy technician, respiratory therapy, food inspector, sports medicine, and research scientist. As noted by www.bls.gov/ooq, all Science, Technology, Engineering, and Mathematics fields are interrelated and build upon each other. Furthermore, STEM occupations are projected to grow faster than all other occupations (13% between 2012-2022).

#### Outcome

History has shown that a biology program is a necessary academic entity for both 2-year and 4-year higher education institutions. As a scientist, it is imperative that our institution reaches out to the public by offering science programs from a Christian foundation. For example, our successful graduates may enter in to health-fields where a Christ-centered foundation is a light on a hill, not only for the MACU graduate, but also for their coworkers, patients, and the patient's family. This example is only one way that a MACU graduate may impact the science community. Below, are quotes from current students:

"I wish we had more options, in terms of classes to take that apply to my career, because I graduate next year." -J.S.

"I wish a biology program was available sooner, if this program was available sooner I would be in a Sonographer program this spring, but not having [the biology program] set me back." - C.R.

"The Biology program is a wonderful addition to MACU. I am currently a senior and am graduating in May. I wish the Biology program would have started sooner. I can only take one class before I graduate in the program. I am excited to see how this program develops and where it will take students in the future!" -M.F.

"It's so incredible to be able to pursue my dreams in education (biology degree), while being able to do what I love (soccer), and grow closer to the Lord. I'm so thankful that biology has been added to the degree program at MACU. If it hadn't been [added], I wouldn't be able to do all the things I've been dreaming about since I was little." - M.D.

#### Future Outlook

Our department's goal is to have additional functional lab rooms for microbiology, chemistry, and an equipment storage by the fall of 2019. This is imperative for those students who are currently majoring in biology as well as those yet to attend MACU. Our

commitment to the biology program will further additional recruitment avenues to MACU by establishing bridge programs from local and statewide 2-year colleges.

Below are enrollment projections for our biology program over the next 3 years. \*1<sup>st</sup> Year (Spring) Note: Lab room max is 20 students

Courses for Biology Majors: Biology I (BIOL 1214) (Spring) 12 Students Anatomy and Physiology I (BIOL 2314) (Spring) 10 Students

\*2<sup>nd</sup> Year (Fall and Spring) Note: Lab room max is 20 students

Courses for Biology Majors: Biology I (BIOL 1214) Projected: 10-20 Students (Fall) Biology II (BIOL 1314) Projected: 10-20 Students (Spring) Anatomy and Physiology I (BIOL 2314) Projected: 10-20 Students (Fall) Anatomy and Physiology II (BIOL 2324) Projected: 10-20 Students (Spring) General Zoology (BIOL 2114) Projected: 10-20 Students (Fall) General Botany (BIOL 2214) Projected: 10-20 Students (Spring)

\*3rd Year (Fall and Spring) Note: Lab room max is 20 students

Courses for Biology Majors: Biology I (BIOL 1214) Projected: 10-20 Students (Fall), 10-20 Students (Spring) Biology II (BIOL 1314) Projected: 10-20 Students (Spring) Anatomy and Physiology I (BIOL 2314) Projected: 10-20 Students (Fall) Anatomy and Physiology II (BIOL 2324) Projected: 10-20 Students (Spring) General Zoology (BIOL 2114) Projected: 10-20 Students (Fall) General Botany (BIOL 2214) Projected: 10-20 Students (Spring) Possible Courses: Human Physiology (BIOL 3214) Cell Biology (BIOL 3334), Genetics (BIOL 3354), Histology (BIOL 4124)

\* General Biology and Environmental Science are taught each semester.

The following goals and objectives are necessary for the ongoing growth of the Biology Program. In order to offer all the courses necessary for a biology degree (including, yet to be developed upper-division courses), it is imperative to have additional faculty available. Currently, adjuncts are teaching non-majors biology courses. With conformation from the Math Chairperson, the School of Math and Science believes it is essential for incoming freshman biology majors to be instructed by the Biology Chairperson, who is grounded in the Christian Faith (courses taught by Chair: Environmental Science, Biology I, Biology II, Anatomy and Physiology I, Anatomy and Physiology II, General Zoology, and General Botany). Furthermore, the Chairperson will teach an additional 3 upper-division courses (Plant Taxonomy, History of Science, and Biology Research).

## 1. Purpose: To ensure the momentum of a growing Biology Program continues.

# 2018 Goals:

- 1. Hire Full-Time Faculty Member: Summer 2018 (specialty Chemistry/Microbiology) **Justification:** Additional assistance for building upper-division courses in Chemistry and Biology, and teach additional courses. In addition to teaching and advising, the new faculty member will assist the Chairperson in seeking funds to continue the growth of the Biology Program.
- Hire Full-Time Biology Lab Instructor: Summer 2018 (40-hour week position)
   Justification: The Lab Instructor will maintain and update all necessary inventories, Material Safety Data Sheets (MSDS), and other safety protocol. In addition, the Lab Assistant will teach Independent-Paced laboratories to increase student retention and diversify course scheduling.
- 3. Seek funding for lab rooms and supplies.
- 4. Continue ordering and updating supplies for ongoing and new biology laboratories.
- 5. Continue building new courses for biology program.
- 6. Convert KH111 to an additional lab room.

# 2019 Goals:

- 1. Continue adding new biology courses with appropriate labs.
- 2. Seek funding for lab rooms and supplies.
- 3. Continue building new courses for biology program.

# 2020 Goals:

- 1. Hire Full-Time Faculty Member: Summer of 2020 (specialty area based on needs) **Justification:** Teach additional courses added to the Biology Program, and assist other fulltime faculty in seeking funds to continue the growth of the Biology Program.
- 2. Seek funding for lab rooms and supplies.
- 3. Continue building new courses for biology program.

**Summary:** Being prepared for future growth is the overall goal of the biology department. To keep the administration informed, students are frequently asking about other course offerings, and when they will be available. The students are excited that Chemistry will be offered in the upcoming spring semester. The adjunct professor for Chemistry (Morgan Rom) also teaches full-time at Heritage Hall, as well as the general biology course for CAS and an additional course for CAGS at MACU.

## 1st Year: 2016-2017 (Hired New Biology Faculty)

Develop/Update Biology Courses with Laboratories:

- Biology for non-majors with lab (update) Completed
- Biology I for majors with lab (develop) Completed
- Biology II for majors with lab (develop) Completed
- Environmental Science for non-majors with lab (develop) Completed

Order books, equipment, and supplies for new courses Ongoing

Considerations for 2<sup>nd</sup> Year development:

- General Zoology with lab (develop) Completed
- General Botany with lab (develop) Offered at a later date
- Anatomy and Physiology I with lab (develop) Completed
- Anatomy and Physiology II with lab (develop) Completed

Search for external supplemental funding opportunities for lab equipment: Anatomy and Physiology I and II, Botany, and Zoology Otoe-Missouria Tribe funding has put this section ahead of schedule

Establish proper disposal protocol for dissected specimens and chemicals: Maintenance Department

## 2<sup>nd</sup> Year: 2017-2018 (Inaugural Year of Biology Program)

Develop Biology Courses with Laboratories:

- General Zoology with lab (develop) Completed
- General Botany with lab (develop) Possible addition to Spring 19
- Anatomy and Physiology I with lab Completed
- Anatomy and Physiology II with lab Completed

Order books, equipment, and supplies for new courses Ongoing

Considerations for 3<sup>rd</sup> Year development:

- Human Physiology with lab Currently developing
- Microbiology with lab (develop)
- Genetics with lab (develop)

Continue searching and applying for supplemental external funding opportunities Ongoing

Create a **budget** for Microbiology room development/renovation to include: Ventilation system for Microbiology, Gas system installed at each lab table, Autoclave purchase, Incubator purchase, Refrigerator purchase, Microscope purchase, Hot water bath purchase etc. Create additional **budgets** for Human Physiology, and Genetics lab equipment. This will become an urgent need as the biology department grows. Ongoing Establish consideration for hiring an additional **Biology Professor** for 3<sup>rd</sup> Year (genetic, microbiology, cell physiology expertise). An ideal hire would be able to teach Chemistry Create **budget** and begin planning stages for a **Chemistry Department** (consultations from active/former college Chemistry professors) Fume hoods, Gas system, storage etc. Hired Chemistry Faculty Member Summer 18

Establish contacts for bridge programs to professional schools i.e. medical, dental, other professional health programs. Ongoing

## **Begin teaching Biology I, Biology II with labs for majors on MACU campus Completed**

Additions to the Biology Program (to be developed): Embryology, Medical Terminology, Special Topics in Biology, Organic Chemistry II, and Biochemistry

## 3<sup>rd</sup> Year: 2018-2019

Develop Biology Courses with Laboratories

- Human Physiology with lab (Currently offering Fall 18)
- Microbiology with lab (develop)
- Genetics with lab (develop)

Order books, equipment, and supplies for new courses Ongoing

Consideration for 4<sup>th</sup> Year development:

- Human Anatomy with lab (develop)
- Cell Biology with lab (develop)
- Evolution (develop)

Continue searching and applying for supplemental external funding Ongoing

Implement plans for Microbiology lab room development May need to move up to year 2 Ongoing (OSSM)

## Hire Biology/Chemistry Professor (Hired Chemistry Faculty)

Create a **budget** for Human Anatomy, and Cell Biology laboratory rooms: Cadaver storage, dissection equipment, establishment of contracts with cadaver supply company, DNA equipment, Gel electrophoresis equipment etc. Ongoing

Complete planning stages for **Chemistry Courses** and **Laboratory** development, (Currently labs conducted at OSSM)

- Chemistry I with lab (develop) This may need to move up to year 2 Completed
- Chemistry II with lab (develop)This may need to move up to year 2 Ongoing

Establish plan for hiring **Chemistry Faculty** for 4<sup>th</sup> Year (a possibility for faculty member to assist in teaching mathematics courses during their initial year of service) This may need to move up to year 2 (Completed due to student needs)

# Begin teaching Zoology with lab, <del>Botany with lab</del>, Anatomy and Physiology I and II with labs on MACU campus in Fall 17 and Spring 18 (completed)

## 4th Year: 2019-2020 This may move to year 3

Current and new Biology/Chemistry Faculty develops/updates Biology courses: (This section's courses will change to Chemistry II, Organic I, and Organic II)

- Human Anatomy with lab (update/develop)
- Cell biology with lab (update/develop)
- Evolution (update/develop)
- Biology Seminar/Journal Club (develop)

Order books, equipment, and supplies for new courses Ongoing

Continue searching and applying for supplemental external funding Ongoing

**\*\*ADDITION: Hire Biology Faculty Member\*\*** to allow further development of upper division course in biology and teach courses for students who are on track to graduate with a biology degree.

Continue development of Chemistry Department Ongoing

Begin teaching Microbiology with lab, Genetics with lab, and Human Physiology with lab on MACU campus Completed and Ongoing

Begin teaching Chemistry I and II with labs on MACU campus Completed OSSM

## 5th Year – beyond 2020

Considerations for development for **Biology Major's** area of concentration

- Comparative Vertebrate Anatomy
- Histology (Offered Spring 19)
- Invertebrate Zoology
- Aquatic Biology
- Plant Anatomy
- Mammology
- Virology
- Immunology
- Pathophysiology
- Medical Terminology (Possible Spring 19)

Continue searching and applying for supplemental external funding Ongoing

# Begin teaching Human Anatomy with lab, Cell Biology with lab, and Evolution on MACU campus

Continue development of Chemistry courses:

- Organic Chemistry I with lab (develop) Ongoing
- Organic Chemistry II with lab (develop) Ongoing

Considerations for future Chemistry course development continues:

- Inorganic Chemistry with lab Ongoing
- Biochemistry Ongoing

\*The 5-year plan is contingent upon funding availability; if funding is available the process may proceed at a faster rate. If funding is not available the timeline may be extended.

## **Biology Courses Developed Including Labs 2016-2020**

- Biology I (core)	4 hours Completed
- Biology II (core)	4 hours Completed
- Environmental Science (non-majors)	4 hours Completed
- General Zoology (core)	4 hours Completed
- General Botany (core)	4 hours
- *Anatomy and Physiology I	4 hours Completed
- *Anatomy and Physiology II	4 hours Completed
- Human Physiology	4 hours Fall 18
- Microbiology (core)	4 hours
- Genetics (core)	4 hours
- Human Anatomy	4 hours
- Cell Biology (**core, OR Evolution)	4 hours
- Evolution (**core, OR Cell Biology)	3 hours
- Biology Seminar/Journal Club (core)	1 hour Fall 19
- General Nutrition	3 hours Completed

\*Anatomy and Physiology I and II are usually taken by students planning to attend nursing school or other health professional schools.

Note: General Biology with lab was updated and Environmental Science was developed for online delivery in 2016-17.

### Chemistry Course Developed and/or Under Development Including Labs 2018-2020

- Chemistry I (required for bio major)	5 hours Completed
--	-------------------

- Chemistry II (required for bio major) 5 hours Fall 18
- Organic Chemistry I (required for majors) 5 hours
- Organic Chemistry II (Med school) 5 hours

# CAMPUS MEMO

To: Directors and Chairs

Cc: Evangelnet

From: Mici Sartin

Date: October 21, 2020

RE: Budget Worksheets



You will find your budget worksheets, both for expenses and capital expenditures for the upcoming 2020-2021 budget year, attached with this memo. The details of what is provided are below:

<u>Detail Budget Worksheet</u>: You are required to complete the spreadsheet labeled Detail Budget Worksheet. This tool will help you plan your budgets by listing in detail your monthly expenses. You will also need to include comments that will help you and the reviewer as your budget(s) are discussed.

<u>Summary Budget</u>. This worksheet will auto-fill as you populate the numbers into the Detail Budget Worksheet and cannot be edited. The Summary Budget will assist in your planning by providing at least two prior years' actual expenses and the prior year budget.

<u>Federal Work Study</u>: Please utilize this space to request student Federal Work Study employees for your department(s). Include number of hours and a description for each position requested. If a rate of pay in excess of minimum wage has been approved for this position, please notate.

<u>Personnel</u>: Please utilize this space to request changes in Personnel and merit increase requests. One must provide your reasoning and evidence supporting these requests.

<u>CapEx</u>: Capital expenditures (fixed assets over \$500 per item) will need to be listed in detail and specific instructions are provided. Any anticipated IT needs will need to be discussed with the Chief Information Officer, Jody Allen, and <u>should not</u> be included on your departmental budget worksheets.

Furniture and Equipment: Furniture and equipment expenses (fixed assets over \$500 per item) will need to be listed in detail and specific instructions are provided.

The budget worksheets will be due to your Vice President on or before November 20th, 2020. Budgets are due to the CFO by Friday December 4th. Thanks for your cooperation. Feel free to contact Michael Foote or Kristin Jasper with any questions and we will be happy to assist!

	Projected Expenses for 2020								Projected Expenses for 2021								
	2020-2021 Proposed Budget																
		June		July	August		September	October	November	December	January	February	March	April	Мау	YR TOTAL	
	Monthly Expense Totals >	\$		\$ 20	\$	4,370	\$ 8,495	\$ 8,495	\$ 8,495	\$ 12,945	\$ 3,395	\$ 7,895	\$ 7,895	\$ 7,895	\$ 4,500	\$ 74,400	
	% of Total Departmental Budget >		0.0%	0.0%		5.9%	11.4%	11.4%	11.4%	17.4%	4.6%	10.6%	10.6%	10.6%	6.0%		-
Dept.	435			-												,	

Account Code	Account Name and Detail Description														
00040	Ostavias Adiumat	•		•	ê 0.475	¢ 0.475	A 0.475	<b>A</b> 0.475	0.075	A 7.075	e 7.075	¢ 7.075	¢ 4.500	¢ 05.400	07.0%
80210	11 hours fall	<b>ə</b> -	• •	ə -	\$ 2,550	\$ 2,550	\$ 2,550	\$ 2,550	\$ 3,375	\$ 1,015	\$ 1,015	<b>\$</b> 1,015	ş 4,500	\$ 65,400	07.970
80210	8 hours spring				φ 2,000	φ 2,000	φ 2,000	\$ 2,000		\$ 2,100	\$ 2,100	\$ 2,100	\$ 2,100		
80210	Lab assistant - 9 labs F, 9 labs S				\$ 1,200	\$ 1,200	\$ 1,200	\$ 1,200		\$ 1,050	\$ 1,050	\$ 1,050	\$ 1,050		
80210	Full-time overload														
80210	Kihega 9 hrs Fall, 9 hrs Spring				\$ 1,350	\$ 1,350	\$ 1,350	\$ 1,350		\$ 1,350	\$ 1,350	\$ 1,350	\$ 1,350		
80210	sting Full-Time Lab Supervisor (see personn	nel tab)													
80210	CAGS Online Courses (fall 9 hrs, Sp 9 hrs)				\$ 3,375	\$ 3,375	\$ 3,375	\$ 3,375	\$ 3,375	\$ 3,375	\$ 3,375	\$ 3,375			
80650	Professional Dues	c	e	e	e	c	c	c	e	e	e	e	e	e	0.0%
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80700	Instructional Supplies	\$-	\$ -	\$ 3,950	<u>\$</u> -	\$-	<u>\$</u> -	\$ 4,050	\$ -	\$ -	\$-	<u>\$</u> -	\$-	\$ 8,000	10.8%
80700	General Biology labs			\$ 200				\$ 200						-	
80700	Microbiology			\$ 750				\$ 750							
80700	Genetics			\$ 800											
80700	Plant Tax			\$ 400				\$ 1,400							
80700	Botany							\$ 800							
80700	Chemistry			\$ 900				\$ 900							
80700	NOTE: Some are offest by Lab Fees														
80700															-
80710	Conjor Supplies	c	e	¢ 400	e	c	e	¢ 400	e	e	e	e	e	\$ 900	1 10/
80710		-	-	\$ 400			-	\$ 400	-	-	-	-	-	φ 000	1.170
80710				¢ 100				÷							
80710															
80710															
80710															
80720	Office Supplies	<del>\$</del> -	\$ 20	\$ 20	\$ 20	\$ 20	\$ 20	\$ 20	\$ 20	\$ 20	\$ 20	\$ <u>20</u>	\$-	\$ 200	0.3%
80720			\$ 20	\$ 20	\$ 20	\$ 20	\$ 20	\$ 20	\$ 20	\$ 20	\$ 20	\$ 20		-	
80720														-	
80720														-	
80720															
80730	Commercial Printing	\$ -	ş -	\$ -	\$-	\$-	\$ -	\$ -	\$ -	\$ -	\$-	\$-	\$-	\$-	0.0%
80730															
80730														-	
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80730														-	
80831	Maint & Repairs - Building	s -	s -	S -	s -	<b>S</b> -	S -	S -	S -	S -	s -	s -	s -	s -	0.0%
80831															
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80831	Foos Othor	e	c	e	e	c	e	c	e	e	e	e	e	c	0.0%
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80520	College Vehicle	<b>\$</b> -	ş -	Ş -	<b>\$</b> -	\$-	\$ -	Ş -	ş -	Ş -	ş -	ş -	ş -	ş -	0.0%
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						0-2021	2020-2021	2020-2021	021-2022
			2017-2018	2018-2019	2019-2020	1st Qtr	Revised	Original	Proposed
GL Description	GL	Res	Actuals	Actuals	Actuals	Actuals	Budget	Budget	Budget
435 - School of Science									
Salaries - Adjunct	80210				34,939.95	600.00	27,506.81	30,000.00	65,400.00
Professional Dues	80650				-	-	-	199.00	-
Instructional Supplies	80700				18,701.09	-	5,700.00	13,700.00	8,000.00
Copier Supplies	80710				-	-	660.00	660.33	800.00
Office Supplies	80720				-	-	200.00	-	200.00
Commercial Printing	80730								-
Maint & Repairs - Building	80831				681.42	-	-	-	-
Fees - Other	81470				960.00	-	-	-	-
College Vehicle	80520								-
Special Projects	81850				21,976.11	-	-	-	-
			-	-	77,258.57	600.00	34,066.81	44,559.33	#REF!
							Total from Detail Budget		74,400.00

#### Federal Work Study Request

student lab assistant for Dr. Kihega 8 hrs per week for 42 weeks = \$2520 (16 week semesters, 8 week summer courses, 1 week before classes begin for each semester)

student lab Assistant for Dr. Fernando 8 hrs per week for 34 weeks = \$2040 (16 week semesters, 1 week before classes begin for each semester)

Request for Full-Time Lab Supervisor (base pay for Masters level instructor)

Due to the addition of the pre-nursing program (including CAGS), an increase in the number of course sections, and the number of hours needed to setup labs and lab exams, order supplies, maintain supplies, inventory supplies, mix chemicals, and maintain live cultures, a full-time lab position would increase the efficency of the School of Science productivity. The lab supervisor will also participate in teaching responsibilities. CAGS will pay a portion of the lab supervisor salary - \$48,000 - 50,000 for a 12 month contract.

#### Instructions

#### To complete proposed capital expenditures sheet:

- 1. Enter your department in cell C2.
- 2. In column C, "Item Description", enter a description for each item you wish to purchase in the appropriate category.
- If more room is needed, you may add lines to the category as necessary.
- 3. Enter the cost for each item you wish to purchase in column D, "Item Cost."
- 4. Each category will subtotal in column E, "Proposed Budget". If you have added lines in a category, check to be sure the subtotal has included them.
- 5. All of the subtotals will come to a grand total in cell E47.
- 6. All requests for Software and Hardware must be reviewed by Jody Allen.

#### To complete proposed furniture & equipment expense sheet:

- 1. Enter your department in cell C2.
- 2. In column C, "Item Description", enter a description for each item you wish to purchase. If more room is needed, you may add lines as necessary.
- 3. Enter the cost for each item you wish to purchase in column D, "Item Cost."
- 4. All the items will total in cell E16. If you have added lines, check to be sure the total has included them.

#### PROPOSED CAPITAL EXPENDITURES

#### Department:

#### Individual Items Over \$500

<u>GL</u> Code	GL Title		Item Description	Item Cost	Proposed Budget
20300	Athletic Fields & Athletic Fields Improvement	its	<u>nem Bestription</u>	<u></u>	Duuger
	ι. Ι	1.			
		2.			
		3.			
		4.			
		5.			
				Subtotal Athletics:	0.00
20400	Buildings & Building Improvements				
		1.			
		2.			
		3.			
		4.			
		5.	0.1		0.00
20500	Enmitting & Eminated		Sub	total Buildings & Improvements:	0.00
20500	Furniture & Equipment	1			
		1. 2			
		2.			
		з. Л			
		- <del>1</del> . 5			
		5.		Subtotal Eurniture & Equipment:	0.00
20600	Software (please see Jody Allen)			Subtour l'unitare de Equipment.	0.00
	2011. m.t (Press 000 002) - 1101.)	1.			
		2.			
		3.			
		4.			
		5.			
				Subtotal Software:	0.00
20610	Computer Hardware (please see Jody Allen)				
		1.			
		2.			
		3.			
		4.			
		5.			
				Subtotal Computer Hardware:	0.00
20900	Vehicles				
		1.			
		2.			
		з. Л			
		ч. 5			
		5.		Subtotal Vehicles:	0.00
				Total Proposed Expenditures:	<u> </u>
				rendered and the second s	

## PROPOSED FURNITURE & EQUIPMENT EXPENSE

Department:

#### **Individual Items Under \$500**

<u>GL</u> Code	GL Title	Item Description	Item Cost	<u>Proposed</u> Budget
81710	Furniture & Equipment			<u> </u>
	1.			
	2.			
	3.			
	4.			
	5.			
	6.			
	7.			
	8.			
	9.			
	10.			

Total Proposed Expenditures: \$ -

# **SPU Notebook**

# 2019 - 2020

**School of Science 435** 

Submitted by

Dr. Harold Kihega and Dr. Deshani Fernando

8/13/2019

# **Mission Statement**

Mid-America Christian University prepares students through a Wesleyan perspective to create, collaborate, and innovate to solve local and global problems for the glory of God through Jesus Christ and the good of society.

#### **University Outcomes**

- 1. SPIRITUAL FORMATION To integrate Christian principles and behaviors in professional and personal experience; (Head and Heart; Encounter and Expression)
- 2. EFFECTIVE COMMUNICATION To communicate effectively and ethically with diverse audiences using a variety of media; (Head and Hands; Engagement and Emphi
- 3. EXAMINATION AND ADOPTION OF IDEAS To examine, reflect, and build upon ideas to transform self and community; (Head, Heart, and Hands; Encounter, Engagem
- 4. CREATIVE PROBLEM SOLVING & ENTREPRENEURSHIP To create innovative solutions to problems; (Head and Hands; Encounter, Engagement, Emphasis, and Exp
- 5. COLLABORATION To engage in ongoing collaborative inquiry and intellectual curiosity for lifelong learning and practice; (Head, Heart, and Hands; Encounter, Engagem
- 6. ETHICAL LEADERSHIP AND VALUES To apply leadership principles and integrate them in professional and personal experience; (Head and Hands; Encounter, Engagi
- 7. EXPERTISE IN THE DISCIPLINE To integrate expertise of the core content of their discipline in real world contexts; (Head and Hands; Engagement and Emphasis)
- 8. ENGAGEMENT IN SCHOLARSHIP To engage with and contribute to scholarly pursuits with creativity and innovation; (Head and Hands; Engagement and Emphasis)
- 9. LOCAL AND GLOBAL APPLICATION To apply skillful and creative expertise to issues facing communities, both locally and globally. (Head and Hands; Engagement, En

#### Board of Trustees' Ends Policies (university's core values-the reason we exit)

- 1. Our students will have a greater ENCOUNTER with God that leads to a spiritual commitment to Christ, a commitment to Christian discipleship, and a commitment to Holy Spirit-filled living.
- 2. Our students will have a greater ENGAGEMENT in learning that prepares students to create, collaborate, and innovate in solving local and global problems.
- 3. Our students will have a greater understanding and **EMPHASIS** of global issues.
- 4. Our students will have a greater EXPRESSION of doing good that reflects the life and ministry of Jesus Christ.

WILDLY IMPORTANT GOALS								
MACU WIG Statements	LEAD Measure 1	LEAD Measure 2	LEAD Measure 3	Type of Scoreboard				
WIG #1								
By May 31, 2019, we will create, implement, and sustain a university-wide culture that becomes a REMARKABLE MACU experience.								
WIG #2								
By May 31, 2019, the University will exceed its 2018-19 projected net revenue by \$610,000 in order to provide cost of living bonuses, as well as future development initiatives.								
Unit WIG Statements	LEAD Measure 1	LEAD Measure 2	LEAD Measure 3	Type of Scoreboard				
The full-time professors in the School of Math and Science will mentor each of the part-time professors teaching courses in the biology and math department by sending monthly emails informing them of our focus for the year - increasing organization in courses.	One monthly email sent to each of the 4 part- time adjuncts in the SMS.							
The School of Math and Science will work with Keller and Associates in applying for 3 NSF/USDA grants - IUSE, S-STEM, AISL.	Participate in conference calls, writing, research as needed.							
Descriptions of the second sec								
Provide a summary narrative below of whether the Unit WIGs were achieved. (Deadline every May 31st)								
1. We worked as mentors for part-time professors. We also worked with part-time professors to find their needs for the new lab. Dr. Fermando worked closely with the part-time professors as her lab is shared in the same room with Genetics and Microbiology. We made monthly contacts on a regular basis for part-time professor needs. 2. Our department applied for the DLT and IUSE grants. We were awarded the DLT Phase I grant and collaborated with Dr. Hinkle as it focuses on K-12. We are still awaiting news on the IUSE proposal. We also met weekly with Keller Associates.								

All Following Worksheets Describe How the Strategic Planning Unit (SPU) Has Strategized To Manage the Whirlwind and Achieve the SPU's Goals.

VISIONING EXERCISE				
Step 1: Describe what you would like your department or school to look like and operate as 5 years from now. Use one word or short sentence descriptors (e.g. activities, relationships, policies, personnel, decisions, programs, attitudes, and so forth.)	Step 1: Describe what you would like your department or school to look like and operate as 5 years from now. Use one word or short sentence descriptors (e.g. activities, relationships, policies, personnel, decisions, programs, attitudes, and so forth.)	1) new full-time biology professor with credentials to teach upper-division biolo courses including cellular/molecular biology and genetics. 2) at least two full-ti biology professors teaching multiple sections of biology courses including upp division biology courses to service the growing number of biology students 3) than 100 biology majors and biology graduates who have been accepted into therapy programs, medical school, and nursing fast-track programs. 4) more t math majors, including secondary math and math multidisciplinary majors.	ogy/math ime ber- more physical than 30	
Step 2: Create a "vision statement." A vision statement is a brief desciption of how your department or school will look like in the future. A vision statement can be a few sentences, a few paragraphs, or even a few pages. Some Strategic Planning Units (SPU's) prefer to create a vision statement acronym to help the SPU's personnel to easily recall the vision.	Step 2: Create a "vision statement." A vision statement is a brief desciption of how your department or school will look like in the future. A vision statement can be a few sentences, a few paragraphs, or even a few pages. Some Strategic Planning Units (SPU's) prefer to create a vision statement acronym to help the SPU's personnel to easily recall the vision.	Creating unique Opportunities for MACU students to make a difference in thei biology and math professions (working on acronym)	ir chosen	
S.I	W.O.T. Analysis (Strengths, Weaknesses, Opportunities, and Threats)			
--	--			
Strengths				
What does our Department/School do well?	Provide quality instruction, utilizing pedagogical best practices. Professons are caring, knowledgeable, likable and work well with students.			
What does the University as a whole do well?				
What do those outside MACU see as the Department's/School's strengths?	Small classroom sizes. Math graduates are known to be problem solvers and work well in teams to solve problems. Biology graduates will be known for the same thing and will be known to be great researchers.			
What is our strongest degree program?	Both biology and math are strong programs, biology is new and is developing but numbers are large for a first year program.			
What do we consider to be the Department's/School's niche(s)?	Students in the math and science programs can discuss a christian perspective in both disciplines and be prepared to enter their chosen STEM profession and make a difference in their world.			
Other Observations				
Weaknesses				
What needs improvement in our Department/School?	We need to build laboraties for Chemistry, microbiology, and Human Anatomy. We need full-time faculty for the growing number of biology students. We need full-time lab assistants to supervise student/athletes.			
Where does the Department/School lack resources?	Laboratories and lab equipment. Biology/Chemistry personnel.			
Are degree programs or student services outdated or ineffective?	no			
What complaints or objections do our customers frequently raise?	The students will have to drive to OSSM to do required lab work. "fear of courses being available to graduate on time". "fear of not having faculty to teach required upper-division biology courses".			
Department's/School's employees lack vital skills?	Both full-time professors are up to date in their discipline and stay abrreast of current peer-reviewed topics.			
Other Observations				
	S.W.O.T. Analysis (Strengths, Weaknesses, Opportunities, and Threats)			
Opportunities				
Are there any trends that we feel will generate opportunities for the Department/School?	Lack of STEM graduates across the US with the President's goal for higher education to graduate one million more STEM graduates over the next 10 years (Holdren, 2013).			
Niches that competitors are missing?	Cross-outing research opportunities for undergraduate students. Student cooperative learning and small class sizes where the professor knows the student. Peer mentorship.			
Any new delivery methods or technologies that would advance our Department/School?	Videotape lab dissections for studen/lathletes that must miss for games.			
Training programs that would benefit employees' skills?				
Degrees that students are asking for?	Chemistry degrees. Statistics emphasis with a math major.			
New needs of customers?	Physics I and II for both math and biology majors.			
Other Observations	We are pursuing grants to receive funding for scholarships, lab equipment, etc.			
Threats				
Obstacles to overcome?	Finances to support the building of laborates and supplying labs with lab equipment. Finding christian scientists that fit into MACU ethos to teach math/science courses. Having too many adjuncts teaching majors courses.			
Where are competitors about to threaten the Department/School's position?	Course equivalency program with competitors looking at our program and seeing the number of full-time facuity.			
Can the Department/School attract and retain the employees it needs?	We can attract and already have several interested faculty members.			
What are the negative economic trends?	Private higher education costs are increasing, compared to public education.			
What are the negative political and social trends?				
Will the Department/School lose any key faculty or staff?	NO			
Any Department/School vulnerabilities?				
Other Observations				

Strengths	Weaknesses
Opportunities	Threats

#### S.W.O.T. Matrix: (Conducted in even numbered years)

SPU Objectives (The Whirlwind)					
SPU Obj. #	Brief Statement of Objective				
	(Objectives are generalized statements on what the SPU wants to achieve. Think of objectives like broad purpose statements.)				
1	Hire quality part-time faculty and/or full-time interdisciplinary math/science faculty/staff				
2	Have OSHA lab safety protocol in place				
3	Supply Chemistry, Genetics and Microbiology labs and upper division biology labs				
4	Promotion of interdisciplinary math and science program offerings and scholarship support for qualified students				
5	Offering more majors within the School of Science				
6	Hire full-time or part-time lab assistant				
7					
8					
9					
10					

	Goals to Improve Department in the Midst of the Whirlwind (S.M.A.R.T. Goals)									
			S = Specific, M = Measural	ble, A = Assignable, R = Realistic, T = Time-bound						
Specific         Measurable         Assignable         [ Resources Required]					Time-	bound				
Obj. No.	HLC Criterion No.	Goal Statement	Description (How do we measure our progress? Level of performance expected? What type of data do you have and where is it?)	Action Steps to Achieve Goal (Action Step Statements Begin with Action Verbs - One year or Less in Duration)	Person	Estimated Budget	Personnel	Capital Resources	Start	End
1		1.1 Hire full-time Biology professor with cellular/molecular biology focus (Priority A)	Courses are being developed each semester and full-time can only teach 3 courses per semester and the number of biology students is growing more than expected so we have multiple sections of Biology 1 and II. We will be adding upper division biology courses for which we will need a full-time hire as part-time biologists are rare to find. MACU must hire a full-time scientist grounded in christian faith to meet the mission of the university.			\$55,000/year			March 2019	Jun 2019
				1.1.1 Develop relationship with other Regional schools to develop a pool of potential faculty possibilities						
				1.1.2 Retain applications that we have on file						
				1.1.3 Develop job description for full-time biology professor to be posted						
				1.1.4 Begin interviewing process						
				1.1.5					L	
1		1.2 Hire full-time or part-time lab instructor (Priority A)	Labs are continually being added as biology courses are developed. The full- time lab instructor would be responsible for teaching certain labs, maintaining increasing inventory, develop safety protocol, maintain Material Safety Data Sheets (MSDS) and maintain live organisms throughout the summer. Additional duties to maintain cooperative research with the University of Arkansas							
				1.2.1 Build a pool of potential lab assistants						
				1.2.2 examine the feasibility of full-time versus two part-time hires						
				1.2.3						
				1.2.4						
2		2.1 Develop a safety protocol for MACU (Priority A)	are followed to prevent liability							
				2.1.1 Collaborate with maintenance and security to develop MACU policy						
				2.1.2 Determine protocol for proper chemical/broken glass/sharps disposal						
				2.1.3						
			Entire the fact the sum slice will be obtained	2.1.4						
3		Chemistry/Microbiology lab (Priority A)	Estimates for the supplies will be obtained							
				3.1.1 Contact Dr. Shore and Dr. Ceballos						
				3.1.2 Continue searching for funding of chemistry/microbiology lab						
	_			3.1.3 Continue writing NSF grants to offset the cost of building labs					<u> </u>	
		4.1 Write recommon detions and inform STEM at idents of	We will measure progress by the number of cabalarabias received both							
4		available scholarship opportunities (Priority B)	internal and external.							
				4.1.1 Have students apply for Federal Work Study						
5		for Chemistry multidisciplinary degree (Priority B)								
				<ol> <li>Talk to Ashley about the number of students requesting Chemistry as a major</li> </ol>						
		5.2 Write a proposal to develop a nursing program								
				5.2.1 Write proposal to develop a nursing major						
		5.3 Develop pre-professional tracks for Biology								
				5.3.1 Research biology pre-professional tracks						
								1		

### Evaluation of SPU Progress (Using Goal as the Measure)

Objective No.	Department/School Goals	Resources Used	Summary of Evaluation Results	How were results used to make improvements?	Percentage Achieved
1	1.1 Hire full-time Biology professor with cellular/molecular biology focus (Priority A)	HR	We hired a part-time faculty for cellular biology/genetics	Hiring quality faculty to teach and develop our upper division courses	50%
	1.1.1 Develop relationship with other Regional schools to develop a pool of potential faculty possibilities		We visited with OCCC, OU, and UCO to find potential candidates		100%
	1.1.2 Retain applications that we have on file	HR	Reviewed and interviewed potential applicants		100%
	1.1.3 Develop job description for full-time biology professor to be posted		We did develop job description		100%
	1.1.4 Begin interviewing process		Interview for potential candidates is ongoing		100%
1	1.2 Hire full-time or part-time lab instructor (Priority A)	HR	We hired a part-time person for lab in Spring 2020		90%
	1.2.1 Build a pool of potential lab assistants		This is an onging process		100%
	1.2.2 examine the feasibility of full-time versus two part-time hires		We were approved for a part-time position using adjunct budget		100%
2	2.1 Develop a safety protocol for MACU (Priority A)	OSHA	Database is currently being built with OSHA protocol by lab assistant		50%
	2.1.1 Collaborate with maintenance and security to develop MACU policy		We are currently working on safety protocol		100%
	2.1.2 Determine protocol for proper chemical/broken glass/sharps disposal		We established areas for broken glassware and pathogens		100%
3	3.1 Get multiple estimates on cost of building and supplies for Chemistry/Microbiology lab (Priority A)	Ward's Scientific			100%
	3.1.1 Contact Dr. Shore		We continued receiving a list of items needed for Chemistry and Microbiology from Dr. Shore		100%
	3.1.2 Continue searching for funding of chemistry/microbiology lab		Currently seeking funding opportunities through NSF and partnerships		100%
	3.1.3 Continue writing NSF grants to offset the cost of building labs		We wrote 1 NSF grant and 1 USDA (IUSE, DLT) that we are awaiting results of NSF		100%
4	4.1 Write recommendations and inform STEM students of available scholarship opportunities (Priority B)	Department Faculty	Wrote recommendations for three biology students, one was accepted into a Doctor of Physical Therapy school and the other is still in the application process. The third was accepted into OU nursing school		100%
	4.1.1 Have students apply for Federal Work Study		Currently we have one federal work study for the department		100%
5	5.1 As Chemistry courses are developed write a proposal for Chemistry multidisciplinary degree (Priority B)	MACU Chemistry Professor	We are done developing. We will research different areas of concentration for multidisciplinary degree		100%
	5.1.1 Talk to Ashley about the number of students requesting Chemistry as a major		Our schools discussed this with Ashley and will be revisiting this year		100%
	5.2 Write a proposal to develop a nursing program	Various Nursing Schools	A proposal was completed for review to develop a nursing program		100%
	5.2.1 Write proposal to develop a nursing major		A proposal was completed for review to develop a nursing program, it was sent through the series of signature approval		100%
	5.3 Develop pre-professional tracks for Biology	Various Universites	Created eight pre-professional tracks for CAS Biology Program		100%
	5.3.1 Research biology pre-professional tracks		Researched various universities to determine proper coursework for pre-preofessional tracks		100%

### DEPARTMENTAL DOCUMENTATION OF PROFESSIONAL DEVELOPMENT

Name	Professional Training Attended	Location	Date
Deshani Fernando	NSF Grant Writing	Ft. Smith, AR	24 Jan-20
Harold Kihega	Blood Borne Pathogen	Oklahoma City, OK	2 Feb-20
			-
			1
			1

	DOCUMENTATION OF PRESENTATIONS OR SEMINARS GIVEN							
Name	Presentations/Seminars Given	Location	Date					
			L					
			-					
			L					
			L					
			<u> </u>					
			<u> </u>					
			<u> </u>					
			1					

DOCUMENTATION OF "MEMBERSHIPS IN" OR "APPOINTMENTS TO" PROFESSIONAL ORGANIZATIONS/BOARDS							
Name	Membership in Professional Organizations	Professional Appointments	Date				
Deshani Fernando	ACS American Chemical Society and Phi Kappa Phi	Member	2019-				
Harold Kihega	AISES American Indian Science and Engineering Society	National Program Reviewer	2019-				
			20				



Biology, Program Review, Section 4

### Wildly Important Goals (WIGs) Data-driven Decision (D3) Forms

# **4DX Notebook**

### 2020 - 2021

**School of Science 435** 

Submitted by: Dr. Fernando and Dr. Kihega

**Chair of School of Science** 

6/1/2020

\*\*\*This notebook should be reviewed at the <u>weekly</u> WIG Meeting

If a SPU accomplishes a WIG before the end of the fiscal year, it may create an additional WIG. Simply access the blank 4DX Notebook located on EvangelNet's "Strategic Planning" tab. Copy a WIG worksheet and have it added behind the WIG # 2 worksheet. If assistance is needed, contact Mr. Jody Allen in IT.

<-- Please enter your department #

<-- Please enter your name



## -Year Strategic Objectives (Growth Paths: 2019-2024)

Objective #1: CUSTOMER EXPERIENCE - We will create a "Remarkable" customer experience for our students and employees.

Objective #2: PRODUCT DIVERSIFICATION - We provide relevant degree programs, certificates, credentials, and job-related curricula that meet the emerging workplace knowledge and skills.

Objective #3: MARKET ACCELERATION - We will grow student enrollments by employing innovative and expanded market penetrations.

Objective #4: CUSTOMER RETENTON - We will employ data analytics to increase retention, persistence, and graduation rates.

Objective #5: RESOURCES - We create learning and work environments that are sustainable and dynamic.

Strat. Obj #	HLC Criterion #	SPU WIG #1 (From X to Y by When)	Discipline 2 Article traditionent	Discipline 2 And the initiation					
		The School of Science will X-research grant		Assignable	[ R	esources Requir	ed]		
2	3	opportunities to Y-submitting grants by deadlines	Charles	Person	Estimated Budget	Personnel	Capital Resources		
			Lead Measure #1	HK, DF and New Hire		Keller Associates, Dr, Fowlkes			
			Weekly meetings with Keller and Associates						
			and the School of Math						

	Assignable	[ R	Resources Required]				
	Person	Estimated Budget	Personnel	Capital Resources			
Lead Measure #2	HK, DF and New Hire		Keller Associates, Dr, Fowlkes				
Weelkly assignments that may include							
Iterature reviews, collecting data, communicating with other institutions and the							
grant committee.							

Strat. Obj #	HLC Criterion #	SPU WIG #2 (From X to Y by When)	Discipline 2 Active transformers		Disciplination of the second s	en e 4	
		The School of Science will X-research need for an		Assignable	[ R	esources Requir	ed]
5	5	additional lab room to Y-cost analysis and other resources e.g. which courses require a lab room	C Lavion	Person	Estimated Budget	Personnel	Capital Resources
			Lead Measure #1	HK, DF	TBD	VWR, Carolina Supply	
			Weekly meeting with new faculty for biology				
			lab room needs				

	Assignable	[ Resources Required]				
	Person	Estimated Budget	Personnel	Capital Resources		
Lead Measure #2	HK, DF	TBD	VWR, Carolina Supply			
Biweekly working with VWR and other science						
companies for lab room needs and quotations						

SPU Professional Development & Service											
Name	Training/Org. Memberships/Presentations/Service	Location	Date								



Accomplishment of SPU W.I.G.s (Complete this sheet as year-end evaluation in May)											
W.I.G. #1	Resources Used	Summary of Evaluation Results	How were results used to make improvements?	Percentage Achieved							
The School of Science will X-research grant opportuniti											
W.I.G. #2	Resources Used	Summary of Evaluation Results	How were results used to make improvements	Percentage Achieved							
The School of Science will X-research need for an additonal lab room to Y-cost analysis and other resources e.g. which courses require a lab room											
			l								

Click the link below to access the HLC Criteria for Accreditation (Effective September 1, 2020). When creating the SPU W.I.G., use the criterion that the SPU W.I.G. addresses. If possible, use the sub-criterion, as well. E.g. 2b

https://www.hlcommission.org/Policies/revised-criteria-for-accreditation.html

Name: Harolu Kinega																		
	W	Idly Importa	ant Goals Lag Result (WIGs) D3 Form															
-																		
RecordedDate Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q12	Q13	Q14	Q15	Q16	Q17	Q18	Q19	Q20	Q26
Recorded Date Select Qu	rter What is your School or Department?	What is your School / Department's WIG? How does your School / Department support one of the University WIGs?	What is the WIG's Lag Measurement? From X to Y by when?	What is the Lead Measure for your School / / Department's WIG? What is the predictive, influenceable, routine measurements that "lead" to the attainment of the Lag Measurement?	By what percentage did you meet your Lead Measure this quarter?	If you have another Lead Measure for your WIG, please indicate Yes. If not, indicate No.	What is the second Lead Measure for your School / Department's WiG? Predictive, influenceable, routine measurement.	By what percentage did you meet your second Lead Measure this quarter?	If you have a third Lead Measure for your WIG, please indicate Yes. If not, indicate No.	What is the third Lead Measure for your School / Department's WIG? Predictive, influenceable, routine measurement.	By what percentage did you meet your third Lead Measure this quarter?	Does your School / Department have a second WIG?	What is your School / Department's second WIG?	What is the Lag Measurement for your School / Department's second WIG?	What is the Lead Measure for your School / Department's second WIG?	By what percentage did you meet your Lead Measure for your second WIG this quarter?	If you have a second Lead Measure for your second WIG, please indicate Yes. If not, indicate No.	How many weekly WIG your School / Department have this quarter?

Departmen	t: School of Sci	ence							
Name: Haro	old Kihega								
			Wild	ly Importa	nt Goals La	ag Result (WIG	s) D3 Forr	n	
EV Veen	Damant Data	a Duava this Dasis	Among of Famo	A attion Dian	Time alling a	Auticineted Decults	Demont Data	A stud Desults	Fuidence Files
Fifear	Report Date	a Drove this Decis	Areas of Focus	Action Plan	Timeline	Anticipated Results	Report Date		Evidence Files
Starting in	) FY 20-21. M	ACU transitioned	to using a 4DX	Notebook to k	keep track of \	NIG reporting.			
FY 2019-2020							5/29/2020	WIG 2 The Schools of Science and Math are	Mici Sartin's
								collaborating to seek funding through NSF and USDA grant opportunities. Applied for NSF-IUSE results pending. Applied for USDA_DLT and was awarded.	office
FY 2019-2020							5/29/2020	Continue development of Biology and Chemistry Courses for the School of Science: CHEM 3203, CHEM 3202, CHEM 3123, BIOL 3333, BIOL 3354, BIOL 3304, BIOL 3363, BIOL 4501. Revamped online NATS	Courses are on D2L
FY 2018-							4/22/2019	Pending EOCs	Pending EOCs
2019									
FY 2018-2019							5/13/2019	WIG 1 was to mentor part-time professors in the school of math and science to increase organization in our courses. We sent emails periodically to part-time professors to inform on our WIG to focus on course organizations.	Contact School of Math and Science for files.
				1			1		1

Department:	School of Scie	nce							
Name: Harol	d Kihega								
				Retent	tion D3 Fo	rm			
Quarter	Report Date	Drove this Dec	Areas of Focus	Action Plan	Timeline	Anticipated Results	Report Date	Actual Results	Evidence Files
AY 4th QTR, Oct - Dec	9/23/2020	BI/Analytics- Retention Portal (on EvangelNet)	Retention goal for the School of Science will	Continue what we are doing, utilize	Fall 2021	from 68% to 70% by Fall 2021			
AY 1st QRT, Jan - Mar	1/15/2020	BI/Analytics- Retention Portal (on EvangelNet)	Improve retention in the School of	Explore new teaching methods such	Spring 2020 to Spring 2021	Retention to go from 64.7% to 65.8% by January 2021	5/6/2020	No new data to review.	No new evidence to report during this time frame.
			Science	as Flipped Classroom and Online			9/23/2020	The School of Science met the retention goal of	See retention portal.
AY 1st QRT, Jul - Sep							10/16/2019	The School of Math and Science was	<u>http:</u> //bodenmarks. macu.
				AY	2018-2019		•		
AY 3rd QTR, Jan - Mar	1/15/2019	EOC	Improving student satisfaction in	Return graded assignments within one week	May 19, 2019	EOC results improve	4/22/2019	No new information	No new information
			Biology courses				5/13/2019	No new data to report during	No new data to report during this

Department: So	chool of Science						
Name: Harold H	Kihega						
		Stu	dent Learn	ing Outcor	me (SLO) N	leasureme	nts
RecordedDate	Q1_1	Q1_2	Q1_3	PO 1/SLO 1.1_1	PO 1/SLO 1.1_2	PO 1/SLO 1.1_3	PO 1/SLO 1.1_4
Recorded Date	Select your Colle	Select your Colle	Select your Colle	Program Outcom	Program Outcom	Program Outcom	Program Outcom
				Student Learnin	Student Learnin	Student Learnin	Student Learnin
12/20/2019 7:04	CAS	School of Math a	Biology, B.S.	1	2	17	15

SLO 1.2_1	SLO 1.2_2	SLO 1.2_3	SLO 1.2_4	PO 2/SLO 2.1_1	PO 2/SLO 2.1_2	PO 2/SLO 2.1_3	PO 2/SLO 2.1_4	SLO 2.2_1
Student Learning	Student Learning	Student Learning	Student Learning	Program Outcom	Program Outcom	Program Outcom	Program Outcom	Student Learning
				Student Learnin	Student Learnin	Student Learnin	Student Learnin	
1	2	17	15	1	2	20	12	1

SLO 2.2_2	SLO 2.2_3	SLO 2.2_4	PO 3/SLO 3.1_1	PO 3/SLO 3.1_2	PO 3/SLO 3.1_3	PO 3/SLO 3.1_4	SLO 3.2_1	SLO 3.2_2
Student Learning	Student Learning	Student Learning	Program Outcom	Program Outcom	Program Outcom	Program Outcom	Student Learning	Student Learning
			Student Learnin	Student Learnin	Student Learnin	Student Learnin		
1	20	13	2	3	17	13	0	0

SLO 3.2_3	SLO 3.2_4	PO 4/SLO 4.1_1	PO 4/SLO 4.1_2	PO 4/SLO 4.1_3	PO 4/SLO 4.1_4	SLO 4.2_1	SLO 4.2_2	SLO 4.2_3
Student Learning	Student Learning	Program Outcom	Program Outcom	Program Outcom	Program Outcom	Student Learning	Student Learning	Student Learning
		Student Learnin	Student Learnin	Student Learnin	Student Learnin			
25	10	0	0	20	15	0	0	20

SLO 4.2_4
Student Learning
15

Department:	School of Scienc	e							
Name: Harol	d Kihega								
				Program Outcomes (PC	) D3 For	m			
Semester	Report Date	Data Drove this Dec	Areas of Focus	Action Plan	Timeline	Anticipated Results	Report Date	Actual Results	<b>Evidence Files</b>
AY 4th QTR, Oct - Dec	12/20/2019	Assignments	Program Outcomes 1, 2 and 3. All POs are based on	Emphasize the importance of attendance and turning in assignments on or before the due date. This was the major cause of not machine avagate there are a set.	May 2020	Decrease the amount of students from 3 (who need improvement) to 0.	5/29/2020	Human Physiology and Cell Biology were assessed for this report	MACU SLO Response Form on Intranet
				AY 2018-2019					
Fall	12/20/2018	Program Outcome Results	SLO 2.1 Draw conclusions based on appropriate	Meet with students one on one more times throughout the semester (this is the first time the course was offered)	May 2019	Increase GPA average for the course.	5/13/2019	BIO II was assessed using SLOs 1.1 and 1.2. 94% met expectations for	MACU SLO Forms on Intranet.
	•		•	AY 2016-2017	, ·	•			
Fall 2016	12/21/2016		Improving student attendance	Make sure all syllabi have a reward for missing less than 3 and a "punishment" to be determined by department members for missing more than two weeks worth of classes	Spring 2017	Grades are improved		Attendance was much better in the spring and therefore grades were reflective of this area of focus.	
Spring 2017	5/25/2017		PO3: Knowledge of Technology: Students embrace technology as an essential tool for learning mathematics	This outcome is assessed in Linear Algebra and Introduction to Statistics final project. In Linear Algebra the online web software did not work this year and therefore I had to use MIT's Scratch software and only 2 students turned it in because I made it bonus rather than an assignment. I will make it required and teach the coding required to make the application to Linear Algebra.	Spring 2018	The goal is that 100% will utilize the coding language utilizing Scratch software and embrace this technology as an essential tool for learning mathematics and its application to Linear Algebra			
Spring 2017	5/25/2017		PO5: Knowledge of different perspectives of Algebra: Students emphasize relationships among quantities including functions, way of representing mathematical relationships, and the analysis of change.	SO5.2 The student will apply fundamental ideas of linear algebra was not met this semester with 3 out of 4 not meeting expectations. This was assessed on the final comprehensive exam. The students showed knowledge on chapter tests but did not display this knowledge at the comprehensive final. Therefore, an effort will be made to continually reteach and refresh and refer back to prior knowledge as progress is made through the semester.					

Department: S	chool of Science								
Name: Harold	Kihega								
				End of Course Surve	v (EoC) D	03 Form			
					, (,				
Semester	Report Date	Data Drove this	Areas of Focus	Action Plan	Timeline	Anticipated Results	Report Date	Actual Results	Evidence Files
Spring	5/29/2020	EoC Survey	The results of the	The Schools of Math and Science	Spring 2021	Q4 Score increase from			
		Results	were reported as the	from 3.22 to 3.38. The goal		2021			
Fall	12/20/2019	EoC Survey Results	The lowest question on the EOC for School of Science	To improve in this area the School of Science will focus on discussions with students when	By next Fall 2020	From 3.36 to 3.53 a 5% increase on Q5	5/29/2020	The EOC results for Q5 decreased from 3.36 to 3.18 (~5% decrease)	Spring 2020 EOC data results
	1		Luca OF Faadhaak	AY 2018	-2019	1		μ	
Fall	12/20/2018	EoC Survey	Q5. Feedback	Offer feedback at the end of	May 2018	Increase EOC from	5/13/2019	Our lowest question was	Results are
		Results	received on	class so everyone who comes		3.28 to 3.35		Q6. regarding feedback to	uploaded to the
			assignments	in late will be included. Inform				improve on future work.	AAIR on MACU's
				AY 2016	-2017				
fall 2016	12/21/2016		Q9 integrating	There is one professor who does	1/5-5/16	This will not be the		Q9 was not the bottom	
			technology	not like to use technology so I		bottom score on EOC		but the average still did	
				will work with him to have him		and will be above 3.0		not improve. It went from	
				implement one new technology				3.71 to 3.69 which was not	
				per semester into the lecture				a significant decrease.	
Spring 2017	5/23/2017		Q6 returning	In the 15-16 academic year we	8/17-5/18	Currently Q6 is the			
			materials in a timely	had made this question the focus		lowest in the school			
			manner	of our WIG. In the 17-18 school		with an average of 3.6.			
				year we will return and add this		Our goal is to improve			
				to our School WIG and inform all		this score to a 3.7 or			
				instructors, including adjunct the		better.			
				focus of the year.					

**Department: School of Science** 

Name: Harold Kihega

### Wildly Important Goals Lag Result (WIG

RecordedDate	Q1	Q2	Q3	Q4	Q5
Recorded Date	Select Quarter	What is your School	What is your School	What is the WIG's	What is the Lead

Starting in FY 20-21, MACU transitioned to using a 4DX Notebook to keep track of WIG reporting.

12/11/2018 10:12 2nd Quarter (Sep-Nov School of Math and Sc WIG 1: The full-time p WIG 1: Increase Q.10 WIG 1: Send monthly

# is) D3 Form

Q6	Q7	Q8	Q9	Q12	Q13	Q14		
By what percentage	If you have another	What is the second	By what percentage	If you have a third	What is the third	By what percentage		
25-50%	Yes	WIG 2: Meetings with 25-50%		No				

Q15	Q16	Q17	Q18	Q19	Q20	Q26
Does your School /	What is your School	What is the Lag	What is the Lead	By what percentage	If you have a second	How many weekly
Yes	WIG 2:The School of N	0 grants to 3 grants by	0-25%	No	1 to 4	

Department: School of Science

Name: Harold Kihega

#### Wildly Important Goals Lag Result (WIGs) D3 Form

FY Year	Report Date	Drove this DecAr	eas of Focus	Action Plan	Timeline	ticipated Resu	Report Date	Actual Results	Evidence Files
Starting in FY 20-21, MACU transitioned to using a 4DX Notebook to keep track of WIG reporting.									
FY 2019-2020							5/29/2020	WIG 2 The Schools of Science and Math are collaborating to seek funding through NSF and USDA grant opportunities. Applied for NSF-IUSE results pending. Applied for USDA_DLT and was awarded.	Mici Sartin's office
FY 2019-2020							5/29/2020	Continue development of Biology and Chemistry Courses for the School of Science: CHEM 3203, CHEM 3202, CHEM 3123, BIOL 3333, BIOL 3354, BIOL 3304, BIOL 3363, BIOL 4501, Revamped online NATS 1014, 2101, 2103	Courses are on D2L
FY 2018-2019							4/22/2019	Pending EOCs	Pending EOCs
FY 2018-2019							5/13/2019	WIG 1 was to mentor part-time professors in the school of math and science to increase organization in our courses. We sent emails periodically to part- time professors to inform on our WIG to focus on course organizations. No assessment available as our Questions changed. WIG 2 was to work with Keller Associates to apply for three grants, 2 NSF and 1 USDA. Two NSF grants were completed one in the Fall and one in the Spring (both pending). Ongoing currently, the USDA grant which is due May 15, 2019.	Contact School of Math and Science for files.

### Biology, Program Review, Section 5

### Program Curriculum Map with

Program Outcome (PO) and Student Learning Outcome (SLO) explanations

Assessment System for School of Math and Science									
Program Outcome 1: Effectively Communicate Core Biological Concepts									
Student Learning Outcome 1.1 Organize scientific data and effectively present through tables, charts, and images									Drogrom
K,S,D	Course or Program	Method of Assessment	Criteria for Measurement	Point of Assessment	Indirect	External	Collection	Data Analysis	Improvement
K,S	Biology I & II	Lab notebook	70% or better	End of semester	Direct	Internal	End of semester	End of school year	Following Fall
Student Learning Outcome 1.2 Critique and Summarize current research topics									
K,S,D	Course or Program Requirement	Method of Assessment	Criteria for Measurement	Point of Assessment	Direct or Indirect Assessment	Internal or External Assessment	Data Collection Timetable	Data Analysis Timetable	Program Improvement Timetable
K,S	Biology I & II	General critique reports	70% or better	During semester	Direct	Internal	End of semester	End of school year	Following Fall
Program Outcome 2	: Apply Quantitativ	e and Qualitative	e Analysis to Inte	rpret Biologie	cal Data				
Student Learning Ou	tcome 2.1 Draw co	nclusions based of	on appropriate re	search proto	col	Internal or	Data		Drogram
K,S,D	Course or Program Requirement	Method of Assessment	Criteria for Measurement	Point of Assessment	Indirect Assessment	External Assessment	Collection Timetable	Data Analysis Timetable	Improvement Timetable
к,s	Biology I & II	Methodology critique of research articles	70% or better	During semester	Direct	Internal	End of semester	End of school year	Following Fall
Student Learning Ou	tcome 2.2 Classify o	organisms accrod	ing to quantitativ	e and qualita	Direct or	Internal or	Data		Program
K,S,D	Course or Program Requirement	Method of Assessment	Criteria for Measurement	Point of Assessment	Indirect Assessment	External Assessment	Collection Timetable	Data Analysis Timetable	Improvement Timetable
K,S	Biology I & II	Dichotomous key	70% correctly identified organisms	Lab assignment s	Direct	Internal	End of semester	End of school year	Following Fall
Program Outcome 3	: Understand the R	elationship of Co	re Concepts Acro	oss Various D	isciplines				
K,S,D	Course or Program	Method of	Criteria for	Point of	Direct or Indirect	Internal or External	Data Collection	Data Analysis	Program Improvement
K,S	Biology I & II	Comprehensive Exams	70% or better	End of semester	Direct	Internal	End of semester	End of school year	Following Fall
Student Learning Ou	tcomo 2 2 Effoctivia	hy coloborato ac	oss disciplinos						
K,S,D	Course or Program	Method of Assessment	Criteria for Measurement	Point of	Direct or Indirect	Internal or External Assessment	Data Collection Timetable	Data Analysis	Program Improvement Timetable
K,S	Biology I & II	Journal club presentations	70% or better	Junior/ Senior year	Direct	Internal	End of semester	End of school year	Following Fall
Program Outcome 4: Implement Correct Labrotory Methodology to Assess Diverse Scientific Systems Student Learning Outcome 4.1 Accurately perform Jahoratory protocol									
K,S,D	Course or Program	Method of Assessment	Criteria for Measurement	Point of	Direct or Indirect	Internal or External Assessment	Data Collection Timetable	Data Analysis	Program Improvement Timetable
K,S	Biology I & II	Laboratory report and	70% or better	Lab reports	Direct	Internal	End of semester	End of School	Following Fall
Student Learning Outcome 4.2 Utilize laboratory equipment correctly and safely									
K,S,D	Course or Program Requirement	Method of Assessment	Criteria for Measurement	Point of Assessment	Direct or Indirect Assessment	Internal or External Assessment	Data Collection Timetable	Data Analysis Timetable	Program Improvement Timetable
K,S	Biology I & II	Observations	70% or better	During weekly labs	Direct	Internal	End of semester	End of School	Following Fall

### Biology, B.S.

### Program Outcome 1: Effectively Communicate Core Science Concepts

Student Learning Outcome 1.1 Organize scientific data and effectively present through tables, charts, and images

Student Learning Outcome 1.2 Critique and Summarize current research topics

# Program Outcome 2: Apply Quantitative and Qualitative Analysis to Interpret Scientific Data

Student Learning Outcome 2.1 Draw conclusions based on appropriate research protocol

Student Learning Outcome 2.2 Classify organisms according to quantitative and qualitative processes

# Program Outcome 3: Understand the Relationship of Core Concepts Across Various Disciplines

Student Learning Outcome 3.1 Apply chemistry, physics, mathematics, and biology content to explain the natural world

Student Learning Outcome 3.2 Effectively collaborate across disciplines

#### Program Outcome 4: Implement Correct Laboratory Methodology to Assess Diverse Scientific Systems

Student Learning Outcome 4.1 Accurately perform laboratory protocol

Student Learning Outcome 4.2 Utilize laboratory equipment correctly and safely
#### Mid-America Christian University- College of Arts and Sciences-School of Science

Biology/B	S Program Curriculum Map	Medical Terminolo	General	Biology I	Biology II	General	General	Anatomy and Physiolog	Anatomy and Physiolog	Human	Human Physiolog	Microbiol	Cell	Genetics	Evolution	Ecology	Histology	Plant Taxonom	History of	Embryolo	Biology	Special Topics in Biology	Chemistry	Chemistry	Organic Chemistry I	Organic Chemistry I	Organic Chemistry	Organic Chemistry	Principles of Biochemistr	
Р	rogram Outcomes	SLOs	BIOL 1013	BIOL 1133	BIOL 1214	BIOL 1314	BIOL 2114	BIOL 2214	BIOL 2314	BIOL 2324	BIOL 3114	9 BIOL 3214	BIOL 3305	BIOL 3333	BIOL 3354	BIOL 3363	BIOL 3404	BIOL 4124	BIOL 4144	BIOL 4213	BIOL 4314	BIOL 4501	BIOL 4901	CHEM 1105	 СНЕМ 1205	CHEM 3103	CHEM 3102	 CHEM 3203	CHEM 3202	, CHEM 3123
1	Effectively Communicate Core Science Concepts	1.1, 1.2	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×
2	Apply Quantitative and Qualitative Analysis to Interpret Scientific Data	2.1, 2.2	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×
3	Understand the Relationship of Core Concepts Across Various Disciplines	3.1, 3.2	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×
4	Implement Correct Labrotory Methodology to Assess Diverse Scientific Systems	4.1, 4.2			×	×	×	×	×	×	×	×	×		×		×	×	×		×			×	×	×	×	×	×	

Student Learning Outcome Measurements

**School Mission/Goals:** The mission of Mid America Christian University's (MACU) Bachelor of Science biology program is to provide students with ample in-depth learning opportunities in biology as well as other courses related to biology, such as mathematics and chemistry. Our students are exposed to critical analysis of real-world issues, scientific methodology to discover interrelationships with other disciplines, and opportunities for effective communication within the academic community.

Students at MACU who are majoring in biology or a multidisciplinary biology program will be prepared to enter professional degree programs, such as medicine, nursing, dentistry, veterinary, teaching, physical therapy, research, and various other graduate programs. MACU's biology curriculum may also lead to careers in Sports Science, Pharmacy, Psychology, Chemistry, and Environmental Science. Additionally, the biology program at MACU will assist pre-service teachers majoring in education by allowing teachers' access to science content while considering age appropriate science curriculum development.

MACU believes that preparing students for success in a biology program requires an abundant opportunity for mentorships with faculty and other students. MACU offers small classroom sizes and access to the faculty throughout the school semester and beyond. A biology program will also give MACU opportunities to develop bridge programs for students to various colleges and universities, professional programs and internships with local organizations. It is the goal of MACU to have high acceptance and employment rate for graduating students entering professional schools, graduate programs, or the work force.

## **Biology Program PO and SLO Explanations**

Biology, B.S.

### **Program Outcome 1: Effectively Communicate Core Science Concepts**

Student Learning Outcome 1.1 Organize scientific data and effectively present through tables, charts, and images

Student Learning Outcome 1.2 Critique and Summarize current research topics

# **Program Outcome 2: Apply Quantitative and Qualitative Analysis to Interpret Scientific Data**

Student Learning Outcome 2.1 Draw conclusions based on appropriate research protocol

Student Learning Outcome 2.2 Classify organisms according to quantitative and qualitative processes

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#### Program Outcome 4: Implement Correct Laboratory Methodology to Assess Diverse Scientific Systems

Student Learning Outcome 4.1 Accurately perform laboratory protocol

Student Learning Outcome 4.2 Utilize laboratory equipment correctly and safely

Departmen Name: Harr	t: School of Sc old Kihega	ence		7																															
		St	udent Leai	ning Outco	ome (SLO) I	Measuren	nents			-																									
RecordedDa Recorded Da	te Q1_1 ite Select your	Q1_2 Coll Select your	Q1_3 Coll Select your 0	PO 1/SLO 1.1 Coll Program Outc	1 PO 1/SLO 1.1_3 Program Outco	PO 1/SLO 1.1_ Program Outco	PO 1/SLO 1.1_ Program Outco	4 SLO 1.2_1 Student Learni	SLO 1.2_2 Student Learni	SLO 1.2_3 Student Learni	SLO 1.2_4 Student Learni	PO 2/SLO 2.1_3 Program Outco	PO 2/SLO 2.1_2 Program Outco	PO 2/SLO 2.1_3 Program Outco	PO 2/SLO 2.1_4 Program Outco	SLO 2.2_1 Student Learni	SLO 2.2_2 Student Learnin	SLO 2.2_3 Student Learnir	SLO 2.2_4 Student Learnir	PO 3/SLO 3.1_1 Program Outco	PO 3/SLO 3.1_3 Program Outco	PO 3/SLO 3.1_3 Program Outco	PO 3/SLO 3.1_4 Program Outco	SLO 3.2_1 Student Learnin	SLO 3.2_2 Student Learni	SLO 3.2_3 Student Learnin	SLO 3.2_4 Student Learnin	PD 4/SLO 4.1_ Program Outco	PO 4/SLO 4.1_ Program Outco	PO 4/SLO 4.1_ Program Outco	PO 4/SLO 4.1_4 Program Outco	SLO 4.2_1 Student Learnin	SLO 4.2_2 Student Learni	SLO 4.2_3 Student Learn	SLO 4.2_4 ir Student Learnin
				Student Learn	iir Student Learni	Student Learni	student Learn	ů.				Student Learni	Student Learni	Student Learnin	Student Learni					Student Learnii	Student Learni	Student Learni	Student Learnin					Student Learni	Student Learn	Student Learni	Student Learni				
12/20/2019	7:0 CAS	School of M	ath Biology, B.S.	1	2	17	15	1	2	17	15	1	2	20	12	1	1	20	13	2	3	17	13	0	0	25	10	0	0	20	15	0	0	20	15

Program Outcome Data-driven Decision (D3) Forms





Thank you for your participation.

If you would like a copy of your results, please click the download pdf option. If you have any questions feel free to contact Institutional Effectiveness.

**Download PDF** 

Below is a summary of your responses

Select your College, School, and Program.

Click to write Choice 1	CAS -
Click to write Choice 2	School of Math and Science
Click to write Choice 3	Biology, B.S.

#### Program Outcome 1: Effectively Communicate Core Biological Concepts

Student Learning Outcome 1.1 Organize scientific data and effectively present through tables, charts, and images

Number of Students Not Met	1
Number of Students Needs Improvement	2
Number of Students Met	17
Number of Students Exceeds Expectations	15
Total	35

Student Learning Outcome 1.2 Critique and Summarize current research topics

Number of Students Not Met	1
Number of Students Needs Improvement	2
Number of Students Met	17
Number of Students Exceeds Expectations	15
Total	35

#### Program Outcome 2: Apply Quantitative and Qualitative Analysis to Interpret Biological Data

Student Learning Outcome 2.1 Draw conclusions based on appropriate research protocol

Number of Students Not Met	1
Number of Students Needs Improvement	2
Number of Students Met	20
Number of Students Exceeds Expectations	12
Total	35

Student Learning Outcome 2.2 Classify organisms according to quantitative and qualitative processes

Number of Students Not Met	1
Number of Students Needs Improvement	1
Number of Students Met	20
Number of Students Exceeds Expectations	13
Total	35

### Program Outcome 3: Understand the Relationship of Core Concepts Across Various

#### Disciplines

Student Learning Outcome 3.1 Apply chemistry, physics, mathematics, and biology content to explain the natural world

the natural world

Number of Students Not Met	2
Number of Students Needs Improvement	3
Number of Students Met	17
Number of Students Exceeds Expectations	13
Total	35

Student Learning Outcome 3.2 Effectively collaborate across disciplines

Number of Students Not Met	0
Number of Students Needs Improvement	0
Number of Students Met	25
Number of Students Exceeds Expectations	10
Total	35

Program Outcome 4: Implement Correct Laboratory Methodology to Assess Diverse Scientific Systems

Student Learning Outcome 4.1 Accurately perform laboratory protocol

Number of Students Not Met	0
Number of Students Needs Improvement	0
Number of Students Met	20
Number of Students Exceeds Expectations	15
Total	35

Student Learning Outcome 4.2 Utilize laboratory equipment correctly and safely

Number of Students Not Met	
Number of Students Needs Improvement	

0

Number of Students Met	20
Number of Students Exceeds Expectations	15
Total	35

Powered by Qualtrics

## Department: School of Science Name: Harold Kihega

#### Program Outcomes (PO) D3 Form

<b>6</b>									E 14
Semester	Report Date	Data Drove th	Areas of Focus	Action Plan	Timeline	ticipated Resu	Report Date	Actual Results	Evidence Files
Oct - Dec	12/20/2019	Assignments	Program Outcomes 1, 2 and 3. All POs are based on Applications in Science concepts	Emphasize the importance of attendance and turning in assignments on or before the due date. This was the major cause of not meeting expectations in these areas.	May 2020	Decrease the amount of students from 3 (who need improvement) to 0.	5/29/2020	Human Physiology and Cell Biology were assessed for this report using SLO 1.1 HP 87.5% meeting expectations and CB 94% meeting expectations. SLOS 2.1, 3.1, 3.2, 4.1, 4.2 were assessed in each individual course Human Physiology, Cell Biology, Chemistry II, and Organic Chemistry I. Percentages for Expectations met are as follows: HP-87.5%, CB-94%, Chem II- 100%, Organic Chem- 100%	MACU SLO Response Form on Intranet
				AY 2018-2	2019				_
Fall	12/20/2018	Program	SLO 2.1	Meet with students one on	May 2019	Increase	5/13/2019	BIO II was assessed	MACU SLO
		Outcome Results	Draw conclusions based on appropriate research protocol	one more times throughout the semester (this is the first time the course was offered) Special Topics BIOL 4901		GPA average for the course.		using SLOs 1.1 and 1.2.94% met expectations for 1.1 and 88% met expectations for 1.2. Histology was assessed using SLOs 4.1 and 4.2.100% met expectations for 4.1 and 90% met expectations for 4.2	Forms on Intranet.
				AY 2016-2	2017				
Fall 2016	12/21/2016		Improving student attendance	Make sure all syllabi have a reward for missing less than 3 and a "punishment" to be determined by department members for missing more than two weeks worth of classes	Spring 2017	Grades are improved		Attendance was much better in the spring and therefore grades were reflective of this area of focus.	
Spring 2017	5/25/2017		PO3: Knowledge of Technology: Students embrace technology as an essential tool for learning mathematics	This outcome is assessed in Linear Algebra and Introduction to Statistics final project. In Linear Algebra the online web software did not work this year and therefore I had to use MIT's Scratch software and only 2 students turned it in because I made it bonus rather than an assignment. I will make it required and teach the coding required to make the application to Linear Algebra.	Spring 2018	The goal is that 100% will utilize the coding language utilizing Scratch software and embrace this technology as an essential tool for learning mathematics and its application to Linear Algebra			
Spring 2017	5/25/2017		PO5: Knowledge of different perspectives of Algebra: Students emphasize relationships among quantities including functions, way of representing mathematical relationships, and the analysis of change.	SO5.2 The student will apply fundamental ideas of linear algebra was not met this semester with 3 out of 4 not meeting expectations. This was assessed on the final comprehensive exam. The students showed knowledge on chapter tests but did not display this knowledge at the comprehensive final. Therefore, an effort will be made to continually reteach and refresh and refer back to prior knowledge as progress is made through the semester.					

End of Course Assessment Results



Total number of	Total															
responses	enrollment	Response Rate			Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	
33	136	24%			3.45	3.54	3.52	3.33	3.24	3.3	3.45	3.33	3.42	3.36	3.42	Questions
																1. My instructor responded to questions within 48 hours.
	Student	Enrollmen	t vs Responses			Average Student Evaluation Score						ion So	core			2. My instructor encouraged my participation in the course through discussions.
		Fall 20	18						0	Fall 2	018					3. My instructor provided regular updates about our class through the News section, discussion boards, class announcements, or other means.
				_							0.0					4. My instructor provided feedback on assignments within 5 class days of the due date for CAGS courses / 2 weeks of the due date for CAS courses.
				-	4										_	5. The feedback received on assignments and discussions helped me learn the material for the course.
						_					_	_	_	_		6. The feedback received on assignments and discussions helped me know how to improve on future work in the course.
Total number	of as				3	3.45	1.54 3.	.52 3.33	3 24	3.3	3.45	.33 3.	.42 3.3	6 3.42		7. The instructor enhanced our course through supplemental relevant content.
response	es 33				Ŭ											8. Instructions on assignments, discussions, and other course expectations were clear.
																9. The concepts, materials, and activities of this course are useful outside of the classroom.
					2 -									-		10. The workload for this course was what should be expected for a course at this level.
																11. The resources provided in the course helped me achieve course objectives.
Total enrollme	nt		136													
					1 -											Open-ended questions
																12. What are the strengths of the instructor?
					0 -											13. How might the instructor be more effective?
	0	50	100	150	, v	Q1	Q2 (	Q3 Q4	Q5	Q6	Q7	Q8 (	29 Q10	Q11		14. What do you like best about this course?
L																15. What do you suggest to improve this course?







Total Total number of enrollmen Response responses t Rate 27%

62 17





Response	Enrollment Instru	ctor Course C	Code Course Nam	School Nam	Q1	Q2	Q3
1	1 Kiheg	ja, Har(BIOL 311	14 1 Human Anat	School of Sc	3.00	4.00	4.00
1	4 Ferna	ando, K CHEM 1 <sup>-</sup>	105 General Che	School of Sc	4.00	4.00	4.00
1	4 Ferna	ando, K CHEM 3 <sup>-</sup>	103 Organic Che	School of Sc	4.00	4.00	4.00
1	6 Kiheg	a, Har BIOL 311	14 1 Human Anat	School of Sc	3.00	4.00	4.00
1	6 Raisl	ey, Bre⊧NATS 10	14 General Biol	School of Sc	2.00	3.00	3.00
1	10 Chris	tian, La BIOL 330	5 1 Microbiology	School of Sc	4.00	4.00	4.00
1	10 Ferna	ando, K CHEM 1 <sup>-</sup>	105 General Che	School of Sc	4.00	4.00	4.00
2	12 Raisl	ey, BreiBIOL 121	I 4 1 Biology I (ma	School of Sc	3.00	2.00	3.00
2	12 Raisl	ey, BreiBIOL 121	I 4 1 Biology I (ma	School of Sc	3.00	3.00	3.00
4	2 Kiheg	a, Har BIOL 431	14 1 Embryology	School of Sc	3.00	4.00	4.00
4	2 Kiheg	a, Har BIOL 431	14 1 Embryology	School of Sc	4.00	4.00	4.00
4	2 Kiheg	a, Har BIOL 431	14 1 Embryology	School of Sc	4.00	3.00	4.00
4	2 Kiheg	a, Har BIOL 431	14 1 Embryology	School of Sc	4.00	3.00	3.00
4	7 Kiheg	a, Har BIOL 431	14 1 Embryology	School of Sc	3.00	4.00	4.00
4	7 Kiheg	a, Har BIOL 431	14 1 Embryology	School of Sc	4.00	4.00	4.00
4	7 Kiheg	a, Har BIOL 431	14 1 Embryology	School of Sc	4.00	3.00	4.00
4	7 Kiheg	a, Har BIOL 431	4 1 Embryology	School of Sc	4.00	3.00	3.00





Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11 Q12
4.00	4.00	4.00	4.00	3.00	4.00	4.00	4.00 Does really v
4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00 She is a grea
4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00 Very educate
4.00	4.00	4.00	4.00	3.00	4.00	4.00	4.00 Does really v
2.00	2.00	2.00	2.00	2.00	2.00	3.00	2.00 He is knowle
4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00 "She is abso
4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00 She is a grea
3.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00 organized
2.00	2.00	2.00	3.00	3.00	2.00	2.00	2.00 He tries to c
4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00 Does well wi
4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
3.00	3.00	3.00	4.00	3.00	4.00	4.00	4.00 Flexibility an
4.00	3.00	3.00	3.00	4.00	4.00	4.00	4.00
4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00 Does well wi
4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
3.00	3.00	3.00	4.00	3.00	4.00	4.00	4.00 Flexibility an
4.00	3.00	3.00	3.00	4.00	4.00	4.00	4.00

#### Questions

- 1. My instructor responded to questions within 48 hours.
- 2. My instructor encouraged my participation in the course through discussions.
- 3. My instructor provided regular updates about our class through the News section, discussion boards,
- 4. My instructor provided feedback on assignments within 5 class days of the due date for CAGS course:
- 5. The feedback received on assignments and discussions helped me learn the material for the course.
- 6. The feedback received on assignments and discussions helped me know how to improve on future w
- 7. The instructor enhanced our course through supplemental relevant content.
- 8. Instructions on assignments, discussions, and other course expectations were clear.
- 9. The concepts, materials, and activities of this course are useful outside of the classroom.
- 10. The workload for this course was what should be expected for a course at this level.
- 11. The resources provided in the course helped me achieve course objectives.

#### **Open-ended questions**

- 12. What are the strengths of the instructor?
- 13. How might the instructor be more effective?
- 14. What do you like best about this course?
- 15. What do you suggest to improve this course?

#### Q13 Q14 Q15

I like his flex Getting to pr More time but due to COVID it was a condensed semester.

"Nothing, sh I like the pro I think having more available hours for tutoring or having more than one tutor for science c "Maybe slow The in depth The class itself is amazing but a lab time that was worked out with coaches would be nice I like his flex Getting to pr More time but due to COVID it was a condensed semester.

More organi: It was intere: Organization

"Nothing, Sh "The profess I think having a better lab assistant would help out. Professor Christian had to set up every "Nothing, sh I like the pro I think having more available hours for tutoring or having more than one tutor for science c give us som a lot to learn be able to make students understand better

be actually the later and size to the trade of defined and of

he actually lithe labs give test study guides

By explaining Getting to le More time but due to COVID we had a condensed semester.

N/A "The subject Maybe add videos for insurance of understanding developments.

By explaining Getting to le More time but due to COVID we had a condensed semester.

N/A "The subject Maybe add videos for insurance of understanding developments.

/thing herself and sometimes our materials were not good to use. I feel like there could be some help in the lab with :

set up and clean up.

End of Course Data-driven Decision (D3) Forms

#### Department: School of Science

Name: Harold Kihega

#### End of Course Survey (EoC) D3 Form

				Auton Dia		A	D		F. 14
Semester	Keport Date	Data Drove this Decision	Areas of Focus	Action Plan	Spring 2021	Anticipated Results	кеport Date	Actual Results	Evidence Files
oping	572972020		Spring 2020 EOC were reported as the School of Math and School of Science (data together). Q4 My instructor provided feedback on assignments within 5 class days of the due date for CAGS courses / 2 weeks of the due date for CAS courses 3.22.	and Science will increase Q4 score by 5% from 3.22 to 3.38. The goal measurement will be Spring 2021	Gynng 2021	Spring 2021			
Fall	12/20/2019	EoC Survey Results	The lowest question on the EOC for School of Science was Q5. Feedback on assignments	To improve in this area the School of Science will focus on discussions with students when returning graded materials.	By next Fall 2020	From 3.36 to 3.53 a 5% increase on Q5	5/29/2020	The EOC results for Q5 decreased from 3.36 to 3.18 (~5% decrease)	Spring 2020 EOC data results
				AY 2018-2019					
Fall	12/20/2018	EoC Survey Results	Q5. Feedback received on assignments helped me learn.	Offer feedback at the end of class so everyone who comes in late will be included. Inform adjuncts as well.	May 2018	Increase EOC from 3.28 to 3.35	5/13/2019	Our lowest question was Q6. regarding feedback to improve on future work. The average score was 3.05. The highest score was Q1. Responding to questions within 48 hours. These questions were not on the previous EOC.	Results are uploaded to the AAIR on MACU's Intranet.
				AY 2016-2017				previous 200.	
fall 2016	12/21/2016		Q9 integrating technology	There is one professor who does not like to use technology so I will work with him to have him implement one new technology per semester into the lecture	1/5-5/16	This will not be the bottom score on EOC and will be above 3.0		Q9 was not the bottom but the average still did not improve. It went from 3.71 to 3.69 which was not a significant decrease.	
Spring 2017	5/23/2017		Q6 returning materials in a timely manner	In the 15-16 academic year we had made this question the focus of our WIG. In the 17-18 school year we will return and add this to our School WIG and inform all instructors, including adjunct the focus of the year.	8/17-5/18	Currently Q6 is the lowest in the school with an average of 3.6. Our goal is to improve this score to a 3.7 or better.			

Instructor/Faculty Evaluations

Since the Biology Program is new, this section is currently being developed.

See below future procedures:

- Review CAS Faculty Evaluations to improve faculty productivity
- Review Student Evaluations to improve teaching strategies
- Review course surveys to improve retention in the School of Science

Professional Development of Faculty

#### **BIOGRAPHICAL SKETCH: Principal Investigator**

Harold Kihega, Jr., Ph.D.

#### A. Professional Preparation

Cameron University (Lawton, Oklahoma)	Health & Physical Science	B.S.	1988
University of Central Oklahoma (Edmond, Oklahoma)	Instruction/Biology	M.E.	1992
Federal Law Enforcement Training Center (Artesia, New Mexico)	Federal Police Training Certification/Constitutional and Criminal Law	Cert.	2000
University of Montana (Missoula, Montana)	Integrative Microbiology and Biochemistry/Native American Research Laboratories	Doctoral Student	2008
University of Oklahoma (Norman, Oklahoma)	Science Education	Ph.D.	2016

#### **B.** Appointments

#### **Professional Appointments**

Mid-America Christian University	Oklahoma City, OK	Biology Department Chairperson/Associate Professor	2016-Present
University of Oklahoma	Norman, OK	Teaching Assistant (Science)	2012-2016
Oklahoma City Community College	Oklahoma City, OK	Adjunct Instructor (Science)	2011-2017
Northern Oklahoma College	Enid, OK	Instructor (Science)	2009-2011
Southwestern Indian Polytechnic Institute	Albuquerque, NM	Instructor (Science)	2003-2008
Hutchinson Community College	Hutchinson, KS	Instructor (Full-time and Adjunct – Science)	2004-2000
Institute of American Indian Arts	Santa Fe, NM	Adjunct Instructor (Science)	2005-2006
Northern Oklahoma College	Tonkawa, OK	Instructor (Full-time and Adjunct)	2001-2006
Oklahoma City CommunityCollege	Oklahoma City, OK	Science Center Instructor/ Adjunct Instructor	1992-2000

#### C. Products

- Kihega, H.G. (2017). The Effects of p53 on Cancer Cells and The Effects of Toxins on Skeletal Muscle Contractions. Research Day Student Presentations, Mid-America Christian University, Oklahoma City, Oklahoma.
- 2. Kihega, H.G. (2014). *Factors Influencing American Indian Higher Education Success*. Diversity Scholar's Event at the University of Oklahoma, Norman, Oklahoma.
- 3. Kihega, H.G. (2008). *Creating Science Curriculum for American Indian Students*. Challenges for Native Faculty, Science for Native Needs Conference, Cass Lake, Minnesota.
- 4. Kihega, H.G. (2007). *Distance Learning in Adult Education*. Quality Education for Minorities, Minneapolis, Minnesota.

#### **D.** Synergistic Activities

- 1. Faculty Sponsor Mid-American Christian University, STEM Club, Oklahoma City, OK.
- 2. University of Oklahoma, School Science and Mathematics Association Annual Convention Proposal Reviewer 2015, Norman, Oklahoma (2015)
- Developed courses in General Nutrition, Biology, Environmental Science, General Zoology, Plant Biology, Anatomy and Physiology, Human Physiology, Comparative Vertebrate Anatomy, Radiation Biology (1992–Present).
- 4. Rainer Fellowship, American Indian Graduate Center, Albuquerque, New Mexico (2012-2015).
- 5. Leadership Development Institute Fellow, TCUP Leadership Development Institute, Minneapolis, Minnesota (2007).
- 6. Southwestern Indian Polytechnic Institute Budget and Reorganization Committee, Albuquerque, New Mexico (2005-2007)
- 7. Southwestern Indian Polytechnic Institute/New Mexico State Curriculum Committee, Albuquerque, New Mexico (2007).

SPU Professional Development & Service								
Name	Training/Org. Memberships/Presentations/Service	Location	Date					
Harold Kihega	MCORE	MACU	2020-Present					
Harold Kihega	AISES Reviewer	MACU	SP 2020					
Harold Kihega	Oklahoma Higher Ed CEP	MACU	FA 2020					
Harold Kihega	State of Oklahoma Nursing Evaluations	MACU	SP 2020					

	SPU Professional Development & Service								
Name	Training/Org. Memberships/Presentations/Service	Location	Date						
Deshani Fernando	Member of American Chemical Society (ACS)	USA	2013- Present						
Deshani Fernando	Reviewer of American Journal of Material Synthesis and Processing	USA	2019- Present						
Deshani Fernando	NSF Grant Writing Workshop	University of Arkansas	14 Jan-20						
Deshani Fernando	Science coach in ACS Science Coaches Program	USA	2020-2021						

SPU Professional Development & Service								
Name	Training/Org. Memberships/Presentations/Service	Location	Date					
Brent Raisley	MCORE	MACU	2020-Present					
Brent Raisley	American Society of Microbiology	MACU	SP 2020					
Brent Raisley	American Society of Cell Biology	MACU	FA 2020					

Retention D3 Forms

## Retention of 2017-2018 \* **School: School of Science**

## **Back to Previous Page**

Level	Division	School	Program	University wide Retention **	Program Retention**	
Undergraduate	CAS	School of Science	Biology, BS	67.86%	57.14%	
			Physics, BS	.00%	.00%	

\*Retention for Student Enrolled in Fall 2017 and Returning in Fall 2018 \*\*Program Retention is different than University Wide Retention due to considering student transfer among difference schools or programs

## Retention of 2018-2019 \* School: School of Science

## **Back to Previous Page**

Level	Division	School	Program	University wide Retention **	Program Retention**	
Undergraduate	CAS	School of Science	Biology, BS	79.41%	64.71%	

\*Retention for Student Enrolled in Fall 2018 and Returning in Fall 2019

\*\*Program Retention is different than University Wide Retention due to considering student transfer among difference schools or programs

## Retention of 2019-2020 \* School: School of Science

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Level	Division	School	Program	University wide Retention **	Program Retention**	
Undergraduate	CAS	School of Science	Biology, BS	77.78%	72.22%	

\*Retention for Student Enrolled in Fall 2019 and Returning in Fall 2020

\*\*Program Retention is different than University Wide Retention due to considering student transfer among difference schools or programs
Name: Harold Kihega

## **Retention D3 Form**

Quarter	Report Date	Drove this Dec	Areas of Focus	Action Plan	Timeline	ticipated Resu	Report Date	Actual Results	<b>Evidence Files</b>
AY 4th QTR, Oct - Dec	9/23/2020	BI/Analytics- Retention Portal (on EvangelNet)	Retention goal for the School of Science will be 70% for the 2020-21 academic year.	Continue what we are doing, utilize scholarship portal to help students with financial needs.	Fall 2021	from 68% to 70% by Fall 2021			
AY 1st QRT, Jan - Mar	1/15/2020	BI/Analytics- Retention Portal (on EvangelNet)	Improve retention in the School of Science	Explore new teaching methods such as Flipped Classroom and	Spring 2020 to Spring 2021	Retention to go from 64.7% to 65.8% by January 2021	5/6/2020	No new data to review.	No new evidence to report during this time frame.
				Online Supplements to improve student performance.			9/23/2020	The School of Science met the retention goal of 68%, retention was 77.78%	See retention portal.
AY 1st QRT, Jul - Sep							10/16/2019	The School of Math and Science was reported to be in the top 5 on retention rates	http: //bodenmarks. macu. edu/ibi_apps/bi p/portal/Retent ion2
				AY 201	8-2019				
AY 3rd QTR, Jan - Mar	1/15/2019	EOC	Improving student	Return graded assignments	May 19, 2019	EOC results improve	4/22/2019	No new information	No new information
			Biology courses	week			5/13/2019	No new data to report during this time frame.	No new data to report during this time frame.
								+	

## Biology, Program Review, Section 13

Program Graduates (Numbers, Graduate Feedback, and other data)

#### **Biology Graduates Data**

	ID number	Last name	Eirot nome	Div.	Div.	Degr.	date degr.	Maiar	Current Status	Institut div.	Major 9 minor dooo	Drogram	Entry data
	ID number	Last name	rirst name	grp.	cue.	cue.	Comerred	wajor	Current Status	cue.	Major & minor desc.	Program	Entry date
									Second year of Doctor of				
1	258105	Stephens	Brittney	CS	С	BS	12/12/19 0:00	081	Physical Therapy Program	SC	Biology	Biology, BS	9/1/15 0:00
									Medical Assistant at Variety				
									Care Family Medicine -				
2	290362	Denton	Nevada	CS	С	BS	5/2/20 0:00	081	Applying to Med School	SC	Biology	Biology, BS	8/17/16 0:00
3	262081	Smith	McKenzie	CS	С	BS	5/2/20 0:00	081	Applying to Med School	SC	Biology	Biology, BS	8/20/18 0:00
									OU Health Science Center				
4	290338	Fairley	Jessica	CS	С	BS	5/2/20 0:00	081	Laboratory	SC	Biology	Biology, BS	8/17/16 0:00
5	295358	Giguiere	Aubrie	CS	С	BS	5/2/20 0:00	081		SC	Biology	Biology, BS	1/10/18 0:00
6	294306	Amos	Larie	CS	С	BS	5/2/20 0:00	081		SC	Biology	Biology, BS	8/16/17 0:00
									Working in OKC analytical				
7	285709	Kowals	Harlee	CS	С	BS	5/2/20 0:00	081	laboratory	SC	Biology	Biology, BS	8/16/17 0:00
8	293533	Woodson	Calon	CS	С	BS	5/2/20 0:00	081	Applying to Med School	SC	Biology	Biology, BS	8/16/17 0:00
									Accepted to University of				
9	276416	Bratcher	Allison	CS	С	BS	5/4/19 0:00	081BA	Arkansas Ph.D program	SC	Biology & Business Admin Multidiscipline	Biology, BS	9/1/15 0:00

Biology, Program Review, Section 14

Recruitment Efforts for Future Students

## Proposal: To seek out future students to enroll at MACU.

With the recent decline in CAGS enrollment I hope to engage on a collaborative action plan to recruit members of American Indian (AI) communities. A plan would involve AI tribal members, allowing them to finish or obtain their undergraduate or graduate degree. I am not aware of any schools reaching out to tribes that will allow them to: a) create cohorts at their workplace in order to enhance persistence, and b) provide them an incentive to finish their degree. An example for (b): Two individuals attend via distance learning one student pays full price while the other half price, the AI tribe splits the cost. I don't know the actual cost to attend online; this is just an idea. Perhaps other will have additional ideas.

- We would need to make or obtain brochures from CAGS
- Obtain a contact list of the Higher Education Coordinators of the AI tribes in OK
- At a later date, Skype with the AI Higher Education Coordinators to answer any questions or concerns

I hope that we can work collaboratively to have a positive impact on our school and our community.

#### **B. Executive Summary**

Through this USDA Rural Utility Service project titled ATOMS (Access To Online Math and Science), Mid-America Christian University (MACU) in Oklahoma City, Oklahoma intends to improve teaching, learning and the self-efficacy of students and teachers in Science, Technology, Engineering, and Mathematics (STEM). ATOMS will deliver subject content for teachers and students, in grades 3-6, in three remote, rural "ATOMS" school districts via synchronous distance learning. Initial project development will focus on providing math and science education to the three elementary schools, where research indicates that interest and persistence in STEM education is lost, leading to fewer students, and particularly underrepresented minorities, (URG's) pursuing higher education and careers in these fields. The delivery method will include four types of live, synchronous interactions through distance learning between: MACU faculty and school system teachers; MACU faculty and ATOMS school system elementary school students; MACU juniors and seniors who are math, science or education majors and ATOMS school system teachers; and between ATOMS teachers at the three networked school system sites.

MACU will serve as a pure Hub for this project and the lead grant applicant and the three schools will be End-Users of this service. The institution, with over 2,500 students, is a private, non-profit institution accredited through the Higher Learning Commission. The institution is requesting a total of \$211,054 in grant funds with a \$31,660 match provided by MACU for a total project cost of \$242,714, which will be used to procure distance learning technology to provide synchronous teaching and learning services at all three End-User sites.

The three economically disadvantaged school systems that will be served by ATOMS include the Peggs Public Schools System in Peggs, Oklahoma, the Alex Public School System in Alex, Oklahoma and the Stilwell Public School System in Stilwell, Oklahoma. Peggs is an unincorporated community and census-designated place in Cherokee County, Oklahoma, with a population of 849, and is 60 miles east of Tulsa, Oklahoma and 160 miles northeast of Oklahoma City. Alex Public Schools is located in Alex, which is a town in Grady County, Oklahoma, population 548, and is located 45 miles south-southwest of Oklahoma City and 10 miles south of Chickasha, Oklahoma. Stilwell is a city and the county seat of Adair County, Oklahoma, located 80 miles southwest of Tulsa, Oklahoma. The population of Stilwell is 4,019. These sites were selected as a result of MACU's interest in building relationships with regional school systems, and recognition by MACU's science, mathematics, and education faculty that these remote, agricultural and frontier communities have limited access to STEM curriculum. In addition to being highly rural communities, the End-User schools have large populations of underrepresented groups (URGs) in STEM including American Indian students and females. These factors increase the importance of providing synchronous STEM learning support to these underserved communities. The End-user sites are all in very low-income areas, with two sites located in counties with poverty rates over 20% and one near 14%.

Through video streaming technology, MACU faculty and math, science and education students will synchronously interact with elementary school teachers and students, including URGs and students from low-income families to support the development of self-efficacy in STEM learning from within the student population. Both MACU and rural elementary school students will increase their knowledge of STEM through live demonstrations of math and science content. Education teacher candidates will develop learning modules in Science and Mathematics to teach synchronously to elementary school students through video streaming technology to learn and understand the content of this curriculum. Four video conferencing rooms will be established at the Hub site and remote sites to provide distance learning opportunities to the rural schools. Each site will have a room dedicated for each grade 3-6. These rooms will allow the sites to broadcast one-to-many or many-to-many video sessions.

Computers with built-in video conferencing will be provided to four faculty at the hub site and four teachers at each remote site. These computers will allow for video conferencing to be used for professional development. Zoom licenses will be provided for each of the conferencing room spaces at both the Hub and remote sites.

Each of the classrooms at the remote site will be provided with ten iPads with video conferencing abilities. These portable devices will allow students to synchronously learn one-on-one if needed. At the same time, the iPads will be preloaded with apps to allow students to practice the STEM learning taught via the video conferencing. This will reinforce the topics and ensure the students are able to practice what they have been taught.

As part of the video conferencing solution, SmartBoards will be installed at three locations. These boards will not only allow for video conferencing, but also allow students at the remote sites to interact with the Smartboard to ask questions or reinforce topics being discussed. Teacher Smartboard training will also be incorporated to increase teacher self-efficacy in the effective use of technology discussed in this proposal.

The ATOMS project will serve approximately 600 students in grades 3-6 at the three rural school districts, including 100 at Peggs, 100 at Alex, and 400 at Stilwell. The project will also serve approximately 20 teachers at these three schools by providing professional development and teaching certifications. In addition to being highly rural communities, End-User schools have large populations of underrepresented groups (URGs) in STEM including, American Indian (AI) students and females. These students will be served by five faculty from MACU's Mathematics, Science and Teacher Education programs, as well as approximately 20 upper classmen from MACU who are Math, Biology or Elementary Education majors. MACU's students mirror the demographics of the region's populations and include over 50% minority students and 59% female students who will serve as peer mentors to ATOMS students. Furthermore, the ATOMS STEM faculty at MACU represents the URG population with one AI faculty member and two female faculty members.

Each of the End-User sites has a mix of adequate (but upgradeable) equipment, aging equipment, or no technology in place. In the case of Alex Public Schools, the display monitors are two years old and sufficient to meet the needs of the video conferencing, so new monitors will not be purchased. The other two End-User sites and MACU have aging equipment that is not reliable and new SmartBoards will replace this aging equipment. All sites have either older classroom computers or computers not powerful enough to handle the video conferencing software and related applications at the quality to provide for a successful program. The purchased equipment will provide new, powerful computers to ensure high quality streaming. None of the sites have video conferencing cameras or iPads in these classrooms. These will be purchased new for the sites.

#### **Publicly Releasable Project Description**

## 1. Title of Project: Access To Online Math and Science (ATOMS)

**2. Description of the proposed End-User site(s):** Mid-America Christian University will serve as the pure Hub for the ATOMS project and deliver synchronous STEM distance learning content for teachers and students at three elementary school End-User sites in the remote, rural school districts of Peggs, Alex and Stilwell, Oklahoma.

3. A brief description of project: Through this USDA Rural Utility Service project titled ATOMS (Access To Online Math and Science), Mid-America Christian University (MACU) in Oklahoma City, Oklahoma intends to improve teaching, learning and the self-efficacy of students and teachers in Science, Technology, Engineering, and Mathematics (STEM). ATOMS will deliver subject content for teachers and students at grades 3-6 in three remote, rural "ATOMS" school districts via synchronous distance learning. Initial project development will focus on providing math and science education to the three school system elementary schools, where research indicates that interest and persistence in STEM education is lost, leading to fewer students, and particularly underrepresented groups (URG's) including minorities and women, pursuing higher education and careers in these fields. The delivery method will include four types of live, synchronous interactions through distance learning between: MACU faculty and school system teachers; MACU faculty and ATOMS school system elementary school students; MACU juniors and seniors who are math, science or education majors and ATOMS school system teachers; and between ATOMS teachers at the three networked school system sites. MACU will serve as a pure Hub for this project and the three schools will be End-Users of this service.

The three school systems that will be served by ATOMS include the Peggs Public Schools System in Peggs, Oklahoma, the Alex Public School System in Alex, Oklahoma and the Stilwell Public School System in Stilwell, Oklahoma. Peggs, Oklahoma, with a population of 849, is 60 miles east of Tulsa, Oklahoma and 160 miles northeast of Oklahoma City. Approximately 100 students in grades 3-6 will be served by the grant. Alex Public Schools located in the Town of Alex, population 548, is located 45 miles south-southwest of Oklahoma City and 10 miles south of Chickasha, Oklahoma. Approximately 100 students in grades 3-6 will be served by the grant. Stilwell is a town located 80 miles southwest of Tulsa, Oklahoma. Approximately 400 students in grades 3-6 will be served by the grant. The population of Stilwell is 4,019. In addition to being highly rural communities, the End-User schools have large populations of underrepresented groups (URGs) in STEM including, American Indian students and females. The project will serve 600 elementary school students at these three schools. The End-user sites are all in very low-income areas, with two sites located in counties with poverty rates over 20% and one near 14%.

Teacher professional development is an integral component of this proposal. Often, teachers at the K-6 school level lack the confidence to teach STEM related content, thus limiting the student's experience and interest in STEM learning (Nadelson, Callahan, Pyke, Hay, Dance & Pfister, 2013). Improving elementary education teaching is essential in order to expose students to formal and informal STEM education. "Since interest in STEM subjects and STEM careers is largely formed by the time children reach the upper elementary and middle school level, it becomes increasingly critical that children's interest in these areas be captured and encouraged during the early to middle elementary grades, long before the point at which they enroll in courses leading to eventual career paths during high school and college (Daugherty, Carter, Swagerty, 2014)." Furthermore, current research shows that racial and ethnic minority student enrollment in advanced STEM courses in high school continues to lag behind nonminority enrollment (Garland & Rapaport, 2018), and that taking advanced high school math and science courses is a significant predictor of college success (Klopfenstein & Thomas, 2009). If students do not have the self-efficacy from early grades, they are more likely to lose interest in STEM education and are less likely to pursue STEM academics in middle or high school. Therefore, the focus of ATOMS is to improve access to STEM teaching and learning through MACU's faculty interactions with elementary education teachers in remote, rural school systems, and connecting MACU's diverse student body with these elementary school students, many who come from similar backgrounds. These peer-to-peer connections, particularly between women and minorities who are underrepresented in the STEM fields are critical to improving self-efficacy for both teachers and students. According to Margolis (2007), student self-efficacy is a strong determinant for student persistence, motivation, and achievement, students with low selfefficacy are likely to give up easily or avoid academic tasks. Further, STEM education is critical to the future of the U.S., and increasing the number of women and minorities in STEM is a particular challenge. The project will provide professional development for approximately 20 teachers at the three End-User schools. The overall goals for ATOMS is to support students and teachers at the ATOMS school districts as follows:

- 1. Increase student interest and self-efficacy in STEM related topics;
- 2. Expand access to STEM related content for grades 3-6 elementary public school students and teachers;
- 3. Increase teacher self-efficacy in teaching STEM related topics by supporting the development of curriculum through regularly scheduled meetings;
- 4. Provide access to online teaching by MACU STEM faculty and upper classmen assigned to work with ATOMS teachers, including synchronous online science and math classes and related curriculum;
- 5. Promote monthly online meetings between ATOMS network teaching staff and MACU faculty to assess curriculum that works and to revise curriculum as needed.
- 6. Create and maintain a peer-to-peer mentorship program between MACU faculty and ATOMS teachers, as well as a mentorship program between MACU math, science, and education upper classmen and elementary public school students.

MACU will serve as a pure Hub for this project and the lead grant applicant and the three schools will be End-Users of this service. MACU, with over 2,500 students, is a private, non-profit institution accredited through the Higher Learning Commission. Five faculty and approximately 20 MACU students will support the ATOMS project each year. The institution is requesting a total of \$211,054 in grant funds with a \$31,660 match provided by MACU for a total project cost of \$242,714, which will be used to procure distance learning technology to provide synchronous teaching and learning services at all three End-User sites.

### C. Scoring Criteria Documentation C-1 Rural Area (Rurality)

## **Rurality Worksheet**

(insert additional rows as needed)

#### Minimum Score of 20 points required for eligibility

Site Number	Site Name	Site Designation (Hub; Hub/End-User; End-User)	Town or Place Name	Census Population	Rurality Score
1	Mid-America Christian University	Hub	Oklahoma City, OK	643,648	0
2	Alex Elementary School	End-User	Alex, OK	560	40
3	Peggs Public School	End-User	Peggs, OK	849	40
4	Stilwell Grade School	End-User	Stilwell, OK	4,002	40

Applicant's Estimated Rurality Score		Rurality Score	
(Sum of Rurality Points ÷ # of End-User Sites)	40	(For Agency Use)	

EXCEPTIONALLY RURAL AREA - 5,000 or less: 40 Points

RURAL AREA - 5,001-10,000: 30 Points

MID-RURAL - 10,001-20,000: 20 Points

URBAN AREA - Over 20,000: 0 Points

NOTE: Enter the hub and end user sites in the same order as shown on the Site Worksheet. Enter the population associated with each hub and end user site. Do not score or include the hub site in the final calculation of the Rurality score. The hub information is required should we determine that a hub site is actually an end user site or combination hub/end user site where it would be scored. See section C1 – Rurality of Application Guide for additional instructions

#### Site Designation SAIPE Site (Hub; Hub/End-User; Percent Poverty, Number Site Name End-User) County All Ages 1 Mid-America Christian University Hub Oklahoma 15.90% 2 Alex Elementary School End-User Grady 13.20% 3 Peggs Public School End-User Cherokee 21.20% 4 Stilwell Grade School Adair End-User 27.20% Average SAIPE (Sum of % Poverty ÷ Number of Sites) 19.34%

## **Economic Need Worksheet**

(Insert additional rows as needed)

Applicant's Estimated Economic Need Score (Enter Points from Scoring Table)

**Scoring Table** 

SAIPE County Percentage:	Points
SAIPE < 10%	0
$10\% \leq \text{SAIPE} < 20\%$	10
$20\% \leq \text{SAIPE} < 30\%$	20
30% < SAIPE	30

NOTE: Enter the hub and end user sites in the same order as shown on the Site Worksheet. Enter the SAIPE percentage associated with each hub and end user site. Do not include the hub site percentage in the final calculation of the Economic Need score. The hub information is required should we determine that a hub site is actually an end user site or a combination hub/end user site where it would be scored. See section C2 – Economic Need on page 16 of Application Guide for additional instructions.

10

Economic Need Score (For Agency Use)

#### **C-3 Special Consideration**

As demonstrated by the following Special Consideration Worksheet, the ATOMS project team is requesting special consideration for this DLT application based on its primary objective of increasing access to Science, Math, Engineering and Mathematics (STEM) curriculum in high need, low-income school districts. The project is aimed at increasing the self-efficacy of three diverse school districts, with a particular emphasis on Stilwell School District where 45% of students are American Indian, Peggs School District's with an 18% American Indian student population and Alex School District's nearly 7% American Indian student population. ATOMS entails providing development of STEM curriculum through teaching by MACU faculty and MACU upper classmen who are either science, math or elementary education majors, as well as creating and participating in a STEM club for students initially at the elementary school level. It also offers mathematics and science teachers who are part of the ATOMS project access to MACU's faculty, who can provide professional development services and who will coordinate supplemental learning content through both online and video conference teaching and learning. The signed Special Consideration Worksheet follows this page.



3500 SW 119th Street Oklahoma City, OK 73170

Phone: 405.692.3176 www.MACU.edu

## Special Consideration Worksheet (sample)

(For more information about Special Consideration, see Section C-4 of the Application Guide )

Our Project's primary pupose is (select appropriate purpose)

STEM Education X

Opioid Treatment

Requests for Special Consideration will not be considered if the application's accompanying Executive Summary and Needs and Benefits section do not support the contention that the project's primary purpose is STEM education or opioid treatment.

I hereby request Special Consideration Points and have adequately supported the request in the appropriate application sections.

Signature of Authorized Representative (Same person who signed the SF - 424, *Application for Federal Assistance*)

5-13-19

Date

Additional Special Consideration Points (for Agency Use)

## C-4 Need for Service and Project Benefits *Need for Service*

Through this USDA Rural Utility Service project titled ATOMS (Access To Online Math and Science), Mid-America Christian University (MACU) in Oklahoma City, Oklahoma intends to improve teaching, learning and the self-efficacy of students and teachers in Science, Technology, Engineering, and Mathematics (STEM). ATOMS will deliver subject content for teachers and students, in grades 3-6, in three remote, rural "ATOMS" school districts via synchronous distance learning. Initial project development will focus on providing math and science education to three elementary schools, where research indicates that interest and persistence in STEM education is lost, leading to fewer students, and particularly underrepresented minorities, (URG's) pursuing higher education and careers in these fields. The delivery method will include four types of live, synchronous interactions through distance learning between: MACU faculty and school system teachers; MACU faculty and ATOMS school system elementary school students; MACU juniors and seniors who are math, science or education majors and ATOMS school system teachers; and between ATOMS teachers at the three networked school system sites. MACU will serve as a pure Hub for this project and the three schools will be End-Users of this service.

The three school systems that will be served by ATOMS include the Peggs Public Schools System in Peggs, Oklahoma, the Alex Public School System in Alex, Oklahoma and the Stilwell Public School System in Stilwell, Oklahoma. Peggs is an unincorporated community and census-designated place in Cherokee County, Oklahoma, with a population of 849, and is 60 miles east of Tulsa, Oklahoma and 160 miles northeast of Oklahoma City. Alex Public Schools located in Alex, a town in Grady County, Oklahoma, population 548, is located 45 miles south-southwest of Oklahoma City and 10 miles south of Chickasha, Oklahoma. Stilwell is a city and the county seat of Adair County, Oklahoma, located 80 miles southwest of Tulsa, Oklahoma. The population of Stilwell is 4,019.

The End-User sites for ATOMS were selected as a result of MACU's interest in building relationships with regional school systems, and recognition by MACU's science and mathematics faculty that these remote, agricultural and frontier communities have limited access to STEM curriculum. In addition to being highly rural communities, the End-User schools have several disparities including large populations of American Indian students and females, who are significantly underrepresented in the STEM fields. These factors increase the importance of providing synchronous STEM learning support to these underserved communities.

Peggs Public School District is located in Peggs, Oklahoma in Cherokee County. The ATOMS project will initially serve a total of 141 students at Peggs Elementary School. A large minority of the county population is American Indian. The Cherokee moved to this area as a result of the forced relocation brought about by the Indian Removal Act of 1830, also known as Of Tears (Burnett, 2009). Peggs is 15 miles northwest of Tahlequah, with a population under 16,000, which is the county seat of Cherokee County, and the capital of the Cherokee Nation. Ten tribal groups reside in Cherokee County including the Cherokee Nation and the Muskogee Creek Nation. Among the student population, 99% of students are female, 79% are American Indian, 20% are White, and the remainder are Latino or more than one race. Further, 62% of students are eligible for free lunch and 15% are eligible for reduced price lunch The Small Area Income and Poverty Estimates – SAIPE for Cherokee County is 21.2%. Despite these disparities, Peggs schools through high school are proficient in mathematics, but lag behind in the sciences. ATOMS is intended to help fill this needs gap. (U.S. Census, 2017 and Public School Reviews for Peggs, 2019)

Alex Public Schools is located in the Town of Alex, pronounced locally as "Elik," which is a town in Grady County, Oklahoma. The population of Alex is 548. Alex is located 45 miles south-southwest of Oklahoma City and 10 miles south of Chickasha, Oklahoma with a population of 16,276. The population density is 82 people per square mile. The racial makeup of the town is 91.18% White, 6.30% Native American with less than 2% Asian and Latino, and less than 1% other races. Alex Elementary School has a total of 157 students with 72% of students eligible for free lunch and 9% for reduced price lunch. The median income for a household in the town was \$27,353 compared to \$49,176 in the State of Oklahoma. The county has a SAIPE estimate of 13.2%. As a low-income area, improving math and science curriculum is critical to this student population. (U.S. Census, 2017 and Public School Reviews for Alex, 2019)

Stilwell is a town located in eastern Adair and Cherokee counties, located 80 miles southwest of Tulsa, Oklahoma. The population of Stilwell is 4,002. The SAIPE for Adair County is over 27%. The racial makeup of the town is 45% American Indian, 39% White, 17% Latino, and the remainder two or more races. According to the National Center for Health Statistics, globally Stilwell's life expectancy is comparable to some of the poorest countries in Africa. ATOMS intends to teach biological concepts that may be applied to healthier lifestyles. (U.S. Census, 2017 and Public School Reviews for Stilwell, 2019)

As the pure Hub site for the ATOMS project, Mid-America Christian University (MACU) is a private, non-profit liberal arts college located in Oklahoma City, Oklahoma that will provide science and math education for the network partners. Accredited by the Higher Learning Commission, MACU's undergraduate student population by gender consists of 59 percent women and 41 percent men. It's population of 2,558 students includes nearly 23% African Americans, 6% Latino and 4% American Indian among other races more than one-half of STEM students come from underrepresented groups (URGs) which closely reflects the population of the three ATOMS school districts including 11% African American, 42% Latino, 2% American Indian, and 36% female students.

Engaging a diverse group of students in the area of STEM is a goal that is essential to the state of Oklahoma due to the large population of underrepresented minorities. As of March 2019, Oklahoma was 7.3% African American, 2.1% Asian, 9% Hispanic, 9.2% American Indian, 68.2% White and 4.6% Other.

Often, teachers at the K-5 school level lack the confidence to teach STEM related content, thus limiting the student's experience and interest in STEM learning (Nadelson, Callahan, Pyke, Hay, Dance & Pfister, 2013). Improving elementary education teaching is essential in order to expose students to formal and informal STEM education. "Since interest in STEM subjects and STEM careers is largely formed by the time children reach the upper elementary and middle school level, it becomes increasingly critical that children's interest in these areas be captured and encouraged during the early to middle elementary grades, long before the point at which they enroll in courses leading to eventual career paths during high school and college (Daugherty, Carter, Swagerty, 2014)." Furthermore, current research shows that racial and ethnic minority student enrollment in advanced STEM courses in high school continues to lag behind nonminority enrollment (Garland & Rapaport, 2018), and that taking advanced high school math and science courses is a significant predictor of college success (Klopfenstein & Thomas, 2009). If students do not have the self-efficacy from early grades, they are more likely to lose interest in STEM education and are less likely to pursue STEM academics in middle or high school. Therefore, the focus of ATOMS is to improve access to STEM teaching and learning through MACU's faculty interactions with elementary education teachers in remote, rural school systems, and connecting MACU's diverse student body with these school system students, many who come from similar backgrounds. These peer-to-peer connections, particularly between women and minorities who are underrepresented in the STEM fields are critical to improving self-efficacy for both teachers and students. According to Margolis (2007), student self-efficacy is a strong determinant for student persistence, motivation, and achievement, students with low selfefficacy are likely to give up easily or avoid academic tasks. Further, STEM education is critical to the future of the U.S., and increasing the number of women and minorities in STEM is a particular challenge.

The overall goals for ATOMS is to support students and teachers at the ATOMS school districts as follows:

- 1. Increase student interest and self-efficacy in STEM related topics;
- 2. Expand access to STEM related content for grades 3-6 elementary public school students and teachers;
- 3. Increase teacher self-efficacy in teaching STEM related topics by supporting the development of curriculum through regularly scheduled meetings;
- 4. Provide access to online teaching by MACU STEM faculty and upper classmen assigned to work with ATOMS teachers, including synchronous online science and math classes and related curriculum;
- 5. Promote monthly online meetings between ATOMS network teaching staff and MACU faculty to assess curriculum that works and to revise curriculum as needed.
- 6. Create and maintain a peer-to-peer mentorship program between MACU faculty and ATOMS teachers, as well as a mentorship program between MACU math, science, and education upper classmen and elementary public school students.

The primary purpose of ATOMS is to increase self-efficacy and interest in STEM for teachers and students, by creating and providing on a synchronous basis, curriculum that can be used for teaching, tutoring and mentoring purposes. ATOMS offer five direct benefits related to this purpose.

## **Benefits Derived from Services**

• Increase student self-efficacy in STEM related topics as measured by student and teacher surveys for approximately 600 elementary students and 12 teachers in grades 3-6 at the three rural elementary schools by 10%: Through video conferencing, MACU math, science and education students will interact with elementary school students, including URGs and students from low-income families to support the development of self-efficacy from within the student population. Both MACU and rural elementary school students will increase their self-efficacy through live demonstrations of online math and science simulations. Elementary school students will practice, and interdisciplinary Math and Science simulations as assigned by ATOMS teachers and presented by MACU Math and Science upper classmen. MACU will work with elementary students by creating and supporting a Rural-STEM club on each campus to meet through video conferencing to learn and understand the content of this curriculum.

As education majors engage elementary school students via distance learning they will emphasize that all students will encounter difficulty with STEM content, but it is part of the learning process. Education majors will teach content synchronously in the classroom. Elementary school teachers will use resources provided by MACU faculty and education majors to reteach, monitor student learning and assess progress of each student in the classroom. Teachers will keep the content so the program eventually becomes self-sustaining for future STEM teachers.

- Expand access to STEM related content for 3-6 grade elementary school students and teachers by 25%: Using video conferencing technology, MACU, preservice teachers and faculty will have opportunity to interact with ATOMS students and teachers in the classroom. MACU preservice teachers will conduct approximately 20 inquiry-based STEM lessons to 3-6th grade students during their regularly scheduled class time, an increase of 25% from currently available curriculum. MACU faculty will provide guidance to MACU, preservice teachers, and as necessary to elementary education teachers. Content delivery may include: live lab demonstrations, curriculum collaboration, and STEM crosscutting curriculum modules for 3-6.
- Increase teacher self-efficacy in teaching STEM related topics by 50%: As many as ten preservice teachers, who currently prepare five inquiry-based STEM lessons per semester and teach one lesson in the field, will teach two inquiry-based STEM lessons each semester to grades 3-6 during regularly scheduled class times using video conferencing technology. The teaching components will benefit

MACU preservice teachers and elementary school students and teachers. ATOMS teachers will continue to have access to the teaching components and will observe preservice teachers, while teaching, to build self-efficacy for both teacher groups. Teaching components may include: citizen science, live demonstrations, sharing of STEM curriculum with ATOMS teachers, and development of age appropriate content aligned to the Oklahoma Academic Standards. Additionally, 306 grade teachers are welcome to visit with MACU faculty via video conferencing during faculty office hours to further enhance their STEM self-efficacy.

- Create and maintain up to 100 peer-to-peer mentorships between MACU students and ATOMS students per semester: At the beginning and end of each semester MACU math, science and education students, mentors and faculty will visit ATOMS elementary schools to meet with potential students and teachers who will volunteer to receive the teacher services MACU STEM faculty and students will work with ATOMS students and teachers to create local STEM clubs at the End User sites. STEM club group meeting times will be scheduled online between MACU's STEM club members and ATOMS students (ATOMS STEM Club) and teachers. Preservice teachers will meet and discuss available teaching times with their participating ATOMS teacher and collaborate on desired STEM topics for the 20 lessons to be taught
- Provide access to mentoring services and online concurrent enrollment for approximately 20 ATOMS elementary education teaching staff annually, as well as the community: MACU STEM faculty will support professional development, including development of STEM curriculum and lessons synchronously throughout the school year. In addition, MACU will offer ATOMS teachers continuing education to advance their ability to teach STEM subject matter. ATOMS teachers will have the opportunity to visit with MACU Admissions to identify online course opportunities that advance teachers' interest in advancing their expertise in STEM subject matter.

#### Previous distance learning and online learning projects experience:

Although MACU does not have previous DLT program experience, the institution has managed distance learning and online learning technologies since 2000. Professor and author, Dr. Peter Drucker, once observed, "In the Industrial Age, people went to college. In the Information Age the college must come to people." This observation has framed the university's advancement of distance learning programs principally by two modalities, Interactive Educational Television (IETV) and the Desire to Learn (D2L) platform for online students. MACU was approved by The Higher Learning Commission: North Central Association of Colleges and Schools (HLC) in 2007 to offer all Bachelor and Master's degree programs 100% online. In 2018, 81% of the university's student population took their coursework online. The D2L platform provides synchronous and asynchronous instructional and communication tools. More information on this experience is contained Tab G – Statement of Experience.

## **D.** Matching Requirements

As demonstrated in the matching contributions Worksheet on the following page, MACU is fully prepared to provide a 15% cash match for all equipment purchases required to carry out ATOMS. A Letter of Commitment stating MACU's commitment to this project and the match follows the Worksheet.

## **Matching Worksheet**

(insert additional rows as needed)

Donor	Proposed
(must provide Documentation Letter from each donor)	Match (\$)
Mid-America Christian University	31660
·	
Proposed Matching Contribution (must equal Line B + Line C in the Budget Worksheet)	\$ 31,660.00
2. Total DLT Grant Request (Must equal Line D in the Budget Worksheet)	\$ 211,064.00
Match Percent (Line 1 ÷ Line 2), must equal 15% of Grant Request	0.150001895



3500 SW 119th Street Oklahoma City, OK 73170

Phone: 405.692.3176 www.MACU.edu

May 13, 2019

USDA Rural Utility Service Distance Learning and Telemedicine Program

To Whom It May Concern:

This letter confirms that Mid-America Christian University (MACU) has approved a 15 percent in-kind match of \$ 31,660 for the purchase of equipment that will be applied towards MACU's proposed USDA Rural Utility Service, Distance Learning and Telemedicine (DLT) grant award in the amount of \$211,054. The total project budget is \$ 242,714. Funds will be used to develop the proposed ATOMS (Access To Online Math and Science) project.

MACU will be partnering with three rural underserved elementary public school districts. These districts are Alex, OK; Stilwell, OK; and Peggs, OK. All three are rural, low-income communities with populations of less than 5,000. These sites were selected as a result of MACU's interest in building relationships with regional school systems, and recognition by MACU's science and mathematics faculty that these remote, agricultural and frontier communities have limited access to STEM curriculum. In addition to being highly rural communities, the End-User schools have several disparities including large populations of American Indian students and females, who are underrepresented in the STEM fields. These factors increase the importance of providing synchronous STEM learning support to these underserved communities.

Through video streaming and interactive learning technology, MACU faculty, and upperclassmen will interact with our elementary school teachers and students, including Under-Represented Groups (URGs) and students from low-income families to support STEM learning for our student population. MACU will provide the END-USER schools with the needed video conferencing equipment to equip a classroom in each grade 3-6. This technology will include much-needed items such as iPads, classroom computers, teacher computers, classroom cameras, and an interactive display monitor called a SmartBoard. MACU's STEM and Education majors, and the rural elementary school students will increase their self-efficacy or ability and confidence to teach and learn the subject matter through live demonstrations of online math and science simulations. MACU pre-service teachers will create, teach, and provide 20 STEM lessons with resources throughout the school year for grades 3-6.

Further, our teachers will have access to five synchronous professional development sessions over the course of the school year. Finally, STEM faculty and upperclassmen will work with elementary students and teachers to create STEM clubs at the school sites. They will meet through video streaming technology to engage and encourage STEM awareness and application through STEM activities.

Per the documentation contained in the Budget section of this proposal, MACU is committed to providing the required match to this DLT proposal. These funds will be used to acquire specific hardware for this project as described in the proposal that is directly linked to the ATOMS project.

Thank you for your consideration of this proposal.

Sincerely,

President John Fozard, Ph.D



# Home of the Longhorns

Dr. Jason James, Superintendent PO Box 188, Alex OK 73002

5/13/2019

Vickie Hinkle Ph.D. Director of Student Teaching Director of Field Experience Mid-America Christian University 3500 S.W. 119th Oklahoma City, OK 73170

Dear Dr. Hinkle,

I am writing on behalf of Alex Public Schools System in support of the USDA Distance Learning and Telemedicine (DLT) project titled ATOMS (Access To Online Math and Science) submitted by Mid-America Christian University (MACU) in Oklahoma City, Oklahoma. MACU and Alex Public Schools System will be partners in this project, with MACU serving as the "Hub" provider of distance learning services and Alex serving as the "End-user" of these Science, Math, Technology and Engineering (STEM) education services.

Alex Public Schools is located in the Town of Alex, population 548, located 45 miles south-southwest of Oklahoma City and 10 miles south of Chickasha, Oklahoma. We chose to partner with MACU as a result of MACU's interest in building relationships with regional school systems, and recognition by MACU's science and mathematics faculty that as we are a remote agricultural community our elementary school, grades K-8, possess limited access to STEM curriculum.

In addition to being a highly rural community, we have a large populations of American Indian students and females, who are underrepresented in the STEM fields. These factors increase the importance of providing synchronous STEM learning support to our underserved community.

Through video streaming and interactive learning technology, MACU faculty, and upper classmen will interact with our elementary school teachers and students, including Under-

# Home of the Longhorns

Dr. Jason James, Superintendent PO Box 188, Alex OK 73002

Represented Groups (URGs) and students from low-income families to support STEM learning for our student population. MACU will provide our school with the needed video conferencing equipment to equip a classroom in each grade 3-6. This technology will include much needed items such as iPads, classroom computers, teacher computers, classroom cameras, and an interactive display monitor called a SmartBoard. MACU's STEM and Education majors, and our rural elementary school students will increase their self-efficacy or ability and confidence to teach and learn the subject matter through live demonstrations of online math and science simulations. MACU pre-service teachers will create, teach and provide 20 STEM lessons with resources throughout the school year for grades 3-6. Further, our teachers will have access to five synchronous professional development sessions over the course of the school year. Finally, STEM faculty and upper classmen will work with elementary students and teachers to create STEM clubs at the school sites. They will meet through video streaming technology to engage and encourage STEM awareness and application through STEM activities.

Alex Public Schools System is committed to providing STEM education to our students. MACU is committed to providing the required 15% project match to support Alex Public School System. Alex is committed to safely storing and maintaining the equipment, and pursuing professional development for our teachers that directly relate to this distance learning project. Our community in central Oklahoma faces significant disparities due to our physical isolation and lack of specialized STEM teachers. Thank you for your efforts to advance STEM education in central Oklahoma.

Sincerely,

ason M. James Superintendent

Alex Public Schools

## Stilwell Public Schools

GERI GILSTRAP, Superintendent 1801 West Locust Stilwell, OK 74960 Phone (918) 696-7001 FAX (918) 696-2193



Board of Education JESS MERRIOTT, President

ROBERT W. MUSKRAT, Vice President DELORES MARTIN, Clerk CHAD SMITH, Member SANDY RITTER, Member

Office of the Superintendent

Vickie Hinkle Ph.D. Director of Student Teaching Director of Field Experience Mid-America Christian University 3500 S.W. 119th Oklahoma City, OK 73170

Dear Dr. Hinkle,

I am writing on behalf of Stillwell Public Schools System in support of the USDA Distance Learning and Telemedicine (DLT) project titled ATOMS (Access To Online Math and Science) submitted by Mid-America Christian University (MACU) in Oklahoma City, Oklahoma. MACU and Stillwell Public Schools System will be partners in this project, with MACU serving as the "Hub" provider of distance learning services and Stilwell serving as the "End-user" of these Science, Math, Technology and Engineering (STEM) education services.

Stillwell Public Schools is in the City of Stillwell, Oklahoma, which is also the county seat of Adair County, and is located 190 miles east of Oklahoma City and 95 miles southeast of Tulsa. The population of Stillwell is 4,002. We chose to partner with MACU as a result of MACU's interest in building relationships with regional school systems, and recognition by MACU's science and mathematics faculty that as we are a remote agricultural community our elementary/middle school, grades K-8, possess limited access to STEM curriculum.

In addition to being a highly rural community, we have a large population of American Indian students and females, who are underrepresented in the STEM fields. These factors increase the importance of providing synchronous STEM learning support to our underserved community.

Through video streaming and interactive learning technology, MACU faculty, and upper classmen will interact with our elementary/middle school teachers and students, including Under-Represented Groups (URGs) and students from low-income families to support STEM learning for our student population. MACU will provide our school with the needed video conferencing equipment to equip a classroom in each grade 3-6. This technology will include much needed items such as iPads, classroom computers, teacher computers, classroom cameras, and an interactive display monitor called a SmartBoard. MACU's STEM and Education majors, and our rural elementary school students will increase their self-efficacy or ability and confidence to teach and learn the subject matter through live demonstrations of online math and science simulations. MACU pre-service teachers will create, teach and provide 20 STEM lessons with resources throughout the school year for grades 3-6. Further, our teachers will have access

to five synchronous professional development sessions over the course of the school year. Finally, STEM faculty and upper classmen will work with elementary students and teachers to create STEM clubs at the school sites. They will meet through video streaming technology to engage and encourage STEM awareness and application through STEM activities.

Stillwell Public Schools System is committed to providing STEM education to our students. MACU is committed to providing the required 15% project match to support Stillwell Public School System. Stillwell is committed to safely storing and maintaining the equipment, and pursuing professional development for our teachers that directly relate to this distance learning project. Our community in central Oklahoma faces significant disparities due to our physical isolation and lack of specialized STEM teachers. Thank you for you efforts to advance STEM education in central Oklahoma.

Sincerely,

ino nin Geri D. Gilstrap

## **Peggs Public School**

P.O. Box 119 Peggs Oklahoma 74452 918-598-3412 Dr. John Cox, Superintendent

5/13/2019

Vickie Hinkle Ph.D. Director of Student Teaching Director of Field Experience Mid-America Christian University 3500 S.W. 119th Oklahoma City, OK 73170

Dear Dr. Hinkle,

I am writing on behalf of Peggs Public Schools System in support of the USDA Distance Learning and Telemedicine (DLT) project titled ATOMS (Access To Online Math and Science) submitted by Mid-America Christian University (MACU) in Oklahoma City, Oklahoma. MACU and Peggs Public Schools System will be partners in this project, with MACU serving as the "Hub" provider of distance learning services and Peggs serving as the "End-user" of these Science, Math, Technology and Engineering (STEM) education services.

Peggs, Oklahoma, is a rural community with a population of 849, and is located 60 miles east of Tulsa, Oklahoma and 160 miles northeast of Oklahoma City. We chose to partner with MACU as a result of MACU's interest in building relationships with regional school systems, and recognition by MACU's science and mathematics faculty that as we are a remote agricultural community our elementary school, grades K-8, possess limited access to STEM curriculum.

In addition to being a highly rural community, we have a large populations of American Indian students and females, who are underrepresented in the STEM fields. These factors increase the importance of providing synchronous STEM learning support to our underserved community.

Through video streaming and interactive learning technology, MACU faculty, and upper classmen will interact with our elementary school teachers and students, including Under-Represented Groups (URGs) and students from low-income families to support STEM learning for our student population. MACU will provide our school with the needed video conferencing equipment to equip a classroom in each grade 3-6. This technology will include much needed items such as iPads, classroom computers, teacher computers, classroom cameras, and an interactive display monitor called a SmartBoard. MACU's STEM and Education majors, and our rural elementary school students will increase their self-efficacy or ability and confidence to teach and learn the subject matter through live demonstrations of online math and science

simulations. MACU pre-service teachers will create, teach and provide 20 STEM lessons with resources throughout the school year for grades 3-6. Further, our teachers will have access to five synchronous professional development sessions over the course of the school year. Finally, STEM faculty and upper classmen will work with elementary students and teachers to create STEM clubs at the school sites. They will meet through video streaming technology to engage and encourage STEM awareness and application through STEM activities. Peggs Public Schools System is committed to providing STEM education to our students. MACU is committed to providing the required 15% project match to support Peggs Public School System. Peggs is committed to safely storing and maintaining the equipment, and pursuing professional development for our teachers that directly relate to this distance learning project. Our community in northeast Oklahoma faces significant disparities due to our physical isolation and lack of specialized STEM teachers. Thank you for you efforts to advance STEM education in northeast Oklahoma.

Sincerely, Dr. John Cox

## E. Scope of Work

ATOMS is a project that is limited in scope that entails providing elementary schools at three low-income school districts in rural Oklahoma with access to distance learning technology that promotes teaching and learning for high need students. Although the program is open to all ATOMS network school district students, the project will emphasize providing additional resources to increase the number of American Indian students, minorities and women who are prepared to continue STEM learning through middle school and high school by increasing interest in and having the self-efficacy to continue to learn STEM content and to eventually attend an institution of higher learning with a major in a STEM field. ATOMS will seek to:

The overall goals for ATOMS is to support students and teachers at the ATOMS school districts as follows:

- 1. Increase student interest and self-efficacy in STEM related topics;
- 2. Expand access to STEM related content for grades 3-6 elementary public school students and teachers;
- 3. Increase teacher self-efficacy in teaching STEM related topics by supporting the development of curriculum through regularly scheduled meetings;
- 4. Provide access to online teaching by MACU STEM faculty and upper classmen assigned to work with ATOMS teachers, including synchronous online science and math classes and related curriculum;
- 5. Promote monthly online meetings between ATOMS network teaching staff and MACU faculty to assess curriculum that works and to revise curriculum as needed.
- 6. Create and maintain a peer-to-peer mentorship program between MACU faculty and ATOMS teachers, as well as a mentorship program between MACU math, science, and education upper classmen and elementary public school students.

The primary specific activity and priority for this project is to purchase Distance Learning Equipment at partnering schools to meet the goal of increasing access to STEM content for grades 3-6. The project will also enable MACU to assist ATOMS teachers with professional development. The project will develop a STEM community between 4 different sites:



## Specific Activities, Persons Responsible, and Timeframes

Once the ATOMS project team is notified about the DLT award, the team will immediately reach out to companies, such as Apple, Smart Technologies, Dell, and

Zoom. Chief Financial Officer, Ms. Mici Sartin, will negotiate final budget details, including finalizing where the matching funds will be invested. Chief Information Officer, Jody Allen, will be responsible for meeting with Information Technology staff from the Peggs, Alex and Stilwell School Systems.

The project will be coordinated between Project Director Dr. Vickie Hinkle (Education), Co-Director Dr. Harold Kihega (Biology), Dr. Deshani Fernando (Chemistry), and Dr. Carol Fowlkes (Math) will work closely with MACU to assess needs and modify curriculum as required to meet the Oklahoma Academic Standards. MACU faculty, including Dean Esther Rehbein, along with teachers from the ATOMS school districts and the MACU Chief Information Officer, will hold an organizational meeting on or shortly after August 1, 2019 by teleconference once notified about the DLT award. A subsequent in-person meeting will be held in November 2019 following purchase and installation of video conferencing technology. The purpose of this meeting is to hold a demonstration of the distance learning technology, to confirm the locations of the technology including connection points and wireline and wireless connectivity, and to review the initial roll-out strategy for student and faculty services as addressed in this proposal.

In addition, the Superintendents of each school district who supported development of the ATOMS project with their respective elementary school teams will designate the site coordinators. The ATOMS contacts are as follows:

Location	Contact	Position
Peggs Elementary School	John Cox	Superintendent
Alex Elementary School	Jason James	Superintendent
Stilwell Elementary School	Geri Gilstrap	Superintendent

These individuals or their designee will be responsible for ensuring that the equipment is maintained in a safe location and locked up at the end of each school day. Site coordinators will also be responsible for monthly check-ins with MACU's Chief Information Officer to report on the status of the technology, and to troubleshoot any difficulties with roll-out. In addition, the project team will utilize troubleshooting services from the proposed vendor, and utilize extended warrantees as required.

Remote locations will own and be responsible for any maintenance needs, including software updates or repairs. All equipment purchased for the remote site will be in compliance with adopter technology standards or vendors of the remote sites to ensure they are able to maintain the equipment once received.

All contracts, including ownership documents, will be overseen by MACU's Vice President of Operations, Chief Operations Officer, and Chief Information Officer (CIO) and provided to MACU's legal services for review. Project implementation will be rolled out as follows:

Timeframe	Activity	Measurements	Responsible team member
July 1, 2019	Notification of DLT Award.	Team notified. First meeting to discuss technology rollout discussed.	Dr. Vickie Hinkle will notify project team.
August 1 2019	Complete budget	Budget completed within 30 days, and contracts signed	MACU CFO completes budget negotiations. CIO and legal complete contracts.
August-November 2019	Finalize technology list	Obtain purchase orders and receipts of delivery. Site work begins using MACU matching funds.	CIO
October-November 2019	Sites finalized, infrastructure hook-ups confirmed.	Connections tested. Initial faculty interactions held on weekly basis	CIO and ATOMS team.
November 2019	Installation of technology	Technology installed at Hub and End User sites	CIO
November 2019	Schedule and curriculum coordination finalized	Faculty and teachers meet in person following install of technology	ATOMS project team led by Dr. Hinkle and Dr. Kihega
November 2019	Faculty training begins at on-site session, completed online	Faculty training for use of Zoom and SMART board technology completed	CIO
December 2019	Draw-down funds, or obtain reimbursement for funds if required. Draft ownership contracts	All transactions verified through receipts and agency portal.	MACU Chief Financial Officer and Legal
January 2020 – July 2020	Ongoing communications between ATOMS network teaching	Improvements made as challenges are identified to improve curriculum	Project Director Vickie Hinkle, Project Co- Director Harold

		1
and learning	and teaching	Kihega, Math
	methods	Faculty Carol
		Fowlkes, and
		Chemistry
		Faculty Deshani
		Fernando

ATOMS will deliver subject content for teachers and students in grades 3-6 level in rural Oklahoma via synchronous distance learning. The delivery method will include live interactions with teachers and students at 3 different elementary school sites. MACU will serve as a pure Hub for this project and the three ATOMS schools will serve as service End-Users. The Co-Director determined the direction of the DLT grant through conversations with the school district's superintendents. There are two items of concern when considering STEM content delivery in each of the three school districts. First, the district's superintendents expressed concern that at the K-6 grade level STEM content was lagging behind other subjects. The reasons were not discussed, but research often indicates that teachers lack content expertise in the STEM area. The second area of concern is the lack of technology in the classroom and the teacher's self-efficacy with technology devices. Therefore, it is MACU's intention to assist each school district with the fundamental problems often encountered in underserved rural school districts.

Interdisciplinary	Oklahoma	Person Responsible	Timeframe
Lesson for grades 3, 4,	Academic		
5 and 6	Standard		
	Alignment		
Grade 3	3-PS2-1 Motion	Early Childhood or	Discuss in weekly
Plan and conduct	and Stability:	Elementary Teacher	meeting, starting in
investigations on the	Forces and	Candidate	November
effects of balanced and	Interactions		Week 1
unbalanced forces on the	(Science)	Professor of Methods	
motion of an object.	3.MD.A.2	of Elementary	
	Measure and	Science or Math	
	estimate liquid	course who will	
	volumes and	collaborate with	
	masses of objects	MACU candidate and	
	using standard	ATOMS teacher.	
	metric units.		
Grade 4	4-PS4-2 Waves	Elementary Teacher	November Week 2
Develop a model to	and Their	Candidate	
describe to describe that	Applications in		
light reflecting from	Technologies for	Professor of Methods	
objects and entering the	Information	of Elementary	
eye allows objects to be	Transfer.	Science or Math	
seen	(Science)	course who will	
	4.G.A.1 Draw	collaborate with	
	points, lines, line	MACU candidate and	
	segments, rays,	ATOMS teacher.	
	angles, and		
	perpendicular and		

	parallel lines		
	Identify these in		
	tone dimensional		
	two-dimensional		
	figures. (Math)		
Grade 5	5-PS2-1 Motion	Elementary Teacher	November Week 3
Support an argument	and Stability:	Candidate	
that the gravitational	Forces and		
force exerted by the	Interactions	Professor of Methods	
Earth is directed down.	(Science)	of Elementary	
		Science or Math	
		course who will	
		collaborate with	
		MACU candidate and	
		ATOMS teacher.	
Grade 6	MS-PS2-5 Motion	Flementary Teacher	November Week 4
Conduct an investigation	and Stability.	Candidate	
and evaluate the	Forces and	Candidate	
and evaluate the	Interaction	Professor of Mathada	
experimental design.	(Seienee)	of Elementery	
	(Science)	Of Elementary	
	0.RP.A.3 Use	Science or Math	
	rational and rate	course who will	
	reasoning to solve	collaborate with	
	real-world	MACU candidate and	
	mathematical	ATOMS teacher.	
	problems. (Math)		
Grade 3	3-LS1-1 From	Early Childhood or	January Week 1
Develop models to	Molecules to	Elementary Teacher	
describe that organisms	Organisms:	Candidate	
have unique and diverse	Structures and		
life cycles.	Processes	Professor of Methods	
	(Science)	of Elementary	
	MP.4 Model with	Science or Math	
	Mathematics	course who will	
	(Math)	collaborate with	
		MACU candidate and	
		ATOMS teacher.	
Grade 4	4-LS1-1 From	Elementary Teacher	January Week 2
Construct an argument	Molecules to	Candidate	
that plants and animals	Organisms:		
have internal and	Structure and	Professor of Methods	
external structures that	Processes	of Flementary	
support that function to	(Science)	Science or Math	
support survival growth	4 G A 3	course who will	
behavior and	Recognize a line	collaborate with	
reproduction	of summetry for a	MACI condidate and	
	two dimensional	ATOMS tooshor	
	two-dimensional	A I UNIS teacher.	
	ingure. (Math)		
Grade 5	5-LS1-1 From	Elementary Teacher	January Week 3
Support an argument	Molecules to	Candidate	
that plants get the	Organisms:		

materials they need for	Structures and	Professor of Methods	
growth chiefly from air	Processes	of Elementary	
and water.	(Science)	Science or Math	
	5.MD.A.1 Convert	course who will	
	among different-	collaborate with	
	sized standard	MACU candidate and	
	measurement units	ATOMS teacher.	
	within a given		
	measurement		
	system (e.g.,		
	convert 5 cm to		
	0.05  m) and use		
	these conversions		
	in solving real		
	world problems		
	(Math)		
Grade 6	MS-LS1-2 From	Elementary Teacher	January Week 4
Develop and use a	Molecules to	Candidate	,
model to describe the	Organisms:		
function of a cell as a	Structures and	Professor of Methods	
whole and ways parts of	Processes.	of Elementary	
cells contribute to the	(Science	Science or Math	
function.	6.EE.C.9 Use	course who will	
	variables to	collaborate with	
	represent to two	MACU candidate and	
	quantities in a	ATOMS teacher.	
	real-world		
	problem that		
	change in		
	relationship to one		
	another. (Math)		
Grade 3	3-LS2-1	Early Childhood or	February Week 1
Construct an argument	Ecosystems:	Elementary Teacher	
that some animals form	Interactions,	Candidate	
groups that help	Energy, and		
members survive.	Dynamics	Professor of Methods	
	(Science)	of Elementary	
	3.NBT Number	Science or Math	
	and Operations in	course who will	
	Base Ten (Math)	collaborate with	
		MACU candidate and	
		ATOMS teacher.	
Grade 5	5-LS2-1	Elementary Teacher	February Week 2
Develop a model to	Ecosystems:	Candidate	
describe the movement	Interactions,		
of matter among plants,	Energy, and	Professor of Methods	
animals, decomposers,	Dynamics	of Elementary	
and the environment.	(Science)	Science or Math	
	MP.2 Reason	course who will	
	abstractly and	collaborate with	
	quantitatively	MACU candidate and	

	(Math)	ATOMS teacher.		
Grade 6 Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem.	MS-LS2-1 Ecosystems: Interactions, Energy, and Dynamics (Science) M6.SP Develop understanding of statistical variability (Math)	Elementary Teacher Candidate Professor of Methods of Elementary Science or Math course who will collaborate with MACU candidate and ATOMS teacher.	February Week 3	
Grade 3 Represent data in tables and graphical displays to describe typical weather conditions expected during a particular season.	3-ESS2-1 Earth's Systems (Science) 3.MD.B.3 Draw a scaled picture graph and a scaled bar graph to represent a data set with several categories. (Math)	Early Childhood or Elementary Teacher Candidate Professor of Methods of Elementary Science or Math course who will collaborate with MACU candidate and ATOMS teacher.	February Week 4	
Grade 4 Analyze and interpret data from maps to describe patterns of Earth's features.	4-ESS2-2 Earth's Systems (Science) 4.MD.A.2 Use the four operations to solve word problems involving distances, intervals of time, liquid volumes, masses of objects, and money. Represent measurement quantities using diagrams such as number line diagrams that feature a measurement scale. (Math)	Elementary Teacher Candidate Professor of Methods of Elementary Science or Math course who will collaborate with MACU candidate and ATOMS teacher.	March Week 1	
Grade 5 Develop a model using an example to describe ways the geosphere, biosphere, hydrosphere.	5-ESS2-1 Earth's Systems (Science) 5.G.A.2 Represent real world and mathematical	Elementary Teacher Candidate Professor of Methods of Elementary	March Week 2	
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are used together MACU candidate and to describe ATOMS teacher.	added or removed	positive and	collaborate with	
to describe ATOMS teacher.		are used together	MACI candidate and	
to describe ATOMS teacher.		to describe	ATOMS teacher	
quantities having		quantities having		

	opposite directions		
	or values: use		
	positive and		
	negative numbers		
	to represent		
	quantities in real-		
	world contexts		
	explaining the		
	meaning of 0 in		
	each situation		
	(Math)		
Grade 4	4-PS3-2 Energy	Elementary Teacher	April Week 3
Make observations to	(Science)	Candidate	ripin weeks
provide evidence that	4 MD C 6	Culturdute	
energy can be	Measure angles in	Professor of Methods	
transferred from place to	whole-number	of Elementary	
place by sound light	degrees using a	Science or Math	
heat and electric	protractor Sketch	course who will	
current	angles of specified	collaborate with	
	measure (Math)	MACU candidate and	
		ATOMS teacher.	
Grade 5	MS-PS3-1 Energy	Elementary Teacher	April Week 4
Use models to describe	(Science)	Candidate	1
that energy in animals'	6.RP.A.1		
food (used for body	Understand the	Professor of Methods	
repair, growth, motion,	concept of ratio	of Elementary	
and to maintain body	and use ratio	Science or Math	
warmth) was once	language to	course who will	
energy from the sun.	describe a ratio	collaborate with	
	relationship	MACU candidate and	
	between two	ATOMS teacher.	
	quantities. (Math)		
Grade 6	MS-PS3-1 Energy	Elementary Teacher	May Week 1
Construct and interpret	(Science)	Candidate	
graphical displays of	6.RP.A.2		
data to describe the	Understand the	Professor of Methods	
relationships of kinetic	concept of a unit	of Elementary	
energy to the mass of an	rate a/b associated	Science or Math	
object and to the speed	with a ratio a:b	course who will	
of an object.	with b=0, and use	collaborate with	
	rate language in	MACU candidate and	
	the context of a	ATOMS teacher.	
Duefoccional	ratio relationship.	Dangan Dann an All	Timofuc
r rolessional Development	Content	rerson kesponsible	imeirame
Grades 3-6 teachers -	3 A 1 3 (Math)	Dr. Carol Fowlkes	September
MACII faculty teach	Explore and	Dr. Harold Kihega	September
cross cutting activity in	develop visual	Dr. Deshani	
	roprosontations of	Fernando	

of bacteria growth (SIR	growing geometric		
modeling)	natterns and		
modeling)	construct the next		
	construct the next		
	steps.		
	3-LSI-I (Science)		
	Students who		
	demonstrate		
	understanding can:		
	Develop models to		
	describe that		
	organisms have		
	unique and diverse		
	life cycles but all		
	have in common		
	birth. growth.		
	reproduction and		
	death		
Grades 3-6 teachers -	3-FSS2-1	Dr. Carol Fowlkes	November
MACII faculty teach	(Science) Students	Dr. Harold Kihega	
weather conditions	who demonstrate	Dr. Deshani	
activity to domonstrate	understanding con:	Eornando	
how becometric pressure	Poprosont data in	remando	
now barometric pressure	toblog and		
is measured			
	graphical displays		
	to describe typical		
	weather conditions		
	expected during a		
	particular season.		
Grades 3-6 teachers -	4-PS4-1 (Science)	Dr. Carol Fowlkes	January
MACU faculty teach	Students who	Dr. Harold Kihega	
oceans activity to	demonstrate	Dr. Deshani	
demonstrate the motion	understanding can:	Fernando	
of water waves	Develop a model		
	of waves to		
	describe patterns		
	in terms of		
	amplitude and		
	wavelength and to		
	show that waves		
	can cause objects		
	to move.		
Grades 3-6 teachers -	5-PS1-4 (Science)	Dr. Carol Fowlkes	March
MACLI faculty teach	Students who	Dr. Harold Kihega	Watch
chemistry activity to	demonstrate	Dr. Dechani	
demonstrate	understanding con-	Fernando	
anvironmentel	Conduct on		
substances and their	investigation to		
substances and their	determine sub-sthese		
application in real world	determine whether		
	the mixing of two		
	or more		
	substances results		

	in new substances.		
Grades 3-6 teachers -	3.A.1.3 (Math)	Dr. Carol Fowlkes	May
MACU faculty teach	Explore and	Dr. Harold Kihega	
geometry activity to	develop visual	Dr. Deshani	
build 3-D models of	representations of	Fernando	
geometric patterns	growing geometric		
(Fractals)	patterns and		
	construct the next		
	steps.		
STEM CLUB		Dr. Carol Fowlkes -	Once STEM club is
		Chair of the Math	created at End-User
		Department at	site STEM club will
		MACU	meet on a monthly
		Dr. Harold Kihega -	basis
		Chair of the Biology	
		Department at	
		MACU	

These interactive lessons, professional development and STEM club meetings are subject to change based on the needs of the teachers and students at the End User sites. In addition, the ATOMS project team has recognized the potential for various projects during launch and through the project period, and is prepared to address these challenges.

# **Challenges and Resolution of Challenges:**

Challenge	Resolution
Incompatible Technology	ATOMS project team has identified outdated equipment
	that cannot effectively or efficiently communicate with
	proposed distance learning platform.
Insufficient technology training	MACU faculty or school district teachers may require
	additional tutorials from MACU's CIO in the use of the
	technology. CIO will provide online small group training,
	individual training if necessary and trouble shooting
	support. School district technology officers are trained in
	use of technology, but will lead local training. CIO will
	visit school districts if necessary during project roll-out
Sustainability	Each site will be required to monitor and maintain
	equipment. Although MACU is responsible for match,
	school districts and MACU may incur some additional
	equipment or software support. Each project site has
	acknowledged these risks by agreeing to advance the
	ATOMS project.
Scheduling	MACU's ATOMS project team, school district
	superintendents and school teachers have agreed to a
	tentative teaching schedule. These schedules may need to
	be adjusted based on size of student teacher and math and
	science major population at MACU, and availability of
	teachers to supervise student teachers. Schedules will be
	adjusted accordingly, but will ensure that majority of
	distance learning is synchronous.

MACU's faculty and administration are actively working to develop its partnership with the ATOMS elementary schools due to the institution's expertise in meeting the needs of students like those in the ATOMS school districts. MACU currently offers fully accredited mathematics, biology and chemistry courses with an average student to faculty ratio of 12:1. MACU students have a wide variety of interaction and methods to get in contact with MACU faculty throughout the day including, face-to-face interaction, online Desire2Learn (D2L/Brightspace, 2018) format, email, and social media. MACU's upper-division college students will be supervised by a faculty member in the content area specific to the needs of the elementary public schools, in the areas of STEM. Faculty and education majors from MACU will also interact with elementary public school teachers at grades 3 thru 6 to assist in content delivery of difficult concepts in STEM related curriculum utilizing a distance learning format. ATOMS will support teachers in STEM curriculum development and self-efficacy related to their ability to teach STEM topics.

Ultimately, the goal of ATOMS is to increase the number of students who are interested in pursuing an academic and career track in a STEM related field. The project team will use distance learning as a tool to help identify academically talented students from elementary schools that are from economically, racially and gender diverse communities. The elementary public schools are the starting point that can ultimately help fill the regional shortfall in the pipeline of STEM undergraduate majors, which will support U.S. competitiveness in the future, a need defined in the 2012 President's Council of Advisors on Science and Technology Report (PCAST, 2012).

MACU teacher education candidates will use content from STEM curriculum that is aligned to the Oklahoma Academic Standards to create 20 STEM lessons. These teacher candidates will teach STEM lessons synchronously in grades 3-6 at the ATOMS school sites. Lesson plans and resources for these lessons will be available for the elementary classroom teacher to use to support the lessons that are taught. Professional development will be made available for these 3-6 grade teachers to also support their teaching of STEM in their classroom. MACU faculty will meet synchronously with classroom teachers to evaluate the lessons taught, as well as the resources and lessons that are made available through this project. Finally, STEM faculty and upper classmen will work with elementary students and teachers to create STEM clubs at the school sites. They will meet through video streaming technology to engage and encourage STEM awareness and application through STEM activities.

The budget on the following pages and repeated in the Telecommunications System Plan (TSP) section reflects the requirements for each project site including the Hub and three End-User Sites

# **Budget Worksheet**

(Insert additional rows as needed)

							ed Cost
Line Item	1	1	ĺ		# of	Grant or Cash	
#	Site Name	Description	1	Unit Cost	Units	Match funds	In-Kind Match
1	MACU	Zoom Licenses	\$	4.00	20.00	\$ 80.00	
2	MACU	iPads	\$	650.00	20.00	\$ 13,000.00	
3	MACU	iPad Case	\$	27.00	20.00	\$ 540.00	
4	MACU	Apple Pencil	\$	90.00	20.00	\$ 1,800.00	
5	MACU	Secure Storage Bins	\$	750.00	1.00	\$ 750.00	
6	MACU	Apps	\$	10.00	20.00	\$ 200.00	
7	MACU	Teacher Computer	\$	1,700.00	4.00	\$ 6,800.00	
8	MACU	Classroom Computers	\$	1,500.00	4.00	\$ 6,000.00	
9	MACU	Smartboard	\$	6,000.00	4.00	\$ 24,000.00	
10	MACU	HDMI Cable	\$	17.00	4.00	\$ 68.00	
11	MACU	Classroom Cameras	\$	1,300.00	8.00	\$ 10,400.00	
12	MACU	Mounting Kit for Camera	\$	150.00	8.00	\$ 1,200.00	
13	MACU	Electrical	\$	300.00	4.00	\$ 1,200.00	
14	MACU	Microphone	\$	300.00	4.00	\$ 1,200.00	
15	MACU	USB extension for microphones	\$	21.00	4.00	\$ 84.00	
16	MACU	USB extension for cameras	\$	532.00	4.00	\$ 2,128.00	
17	MACU	Document Camera	\$	250.00	2.00	\$ 500.00	
18	MACU	Wireless Access Points	\$	1,245.00	4.00	\$ 4,980.00	
19	MACU	Wireless Access License	\$	60.00	4.00	\$ 240.00	
20	Alex Elementary School	Zoom Licenses	\$	15.00	4.00	\$ 60.00	
21	Alex Elementary School	iPads	\$	410.00	40.00	\$ 16,400.00	
22	Alex Elementary School	iPad Case	\$	27.00	40.00	\$ 1,080.00	
23	Alex Elementary School	Secure Storage Bins	\$	330.00	4.00	\$ 1,320.00	
24	Alex Elementary School	Apps	\$	10.00	40.00	\$ 400.00	
25	Alex Elementary School	Teacher Computer	\$	1,027.00	4.00	\$ 4,108.00	
26	Alex Elementary School	Classroom Computers	\$	1,350.00	4.00	\$ 5,400.00	
27	Alex Elementary School	HDMI Cable	\$	17.00	4.00	\$ 68.00	

28	Alex Elementary School	Classroom Cameras	\$ 1,300.00	4.00	\$ 5,200.00	
29	Alex Elementary School	Mounting Kit for Camera	\$ 150.00	8.00	\$ 1,200.00	
30	Alex Elementary School	Electrical	\$ 300.00	4.00	\$ 1,200.00	
31	Alex Elementary School	Microphone	\$ 300.00	4.00	\$ 1,200.00	
32	Alex Elementary School	USB extension for microphones	\$ 21.00	4.00	\$ 84.00	
33	Alex Elementary School	USB extension for cameras	\$ 532.00	4.00	\$ 2,128.00	
34	Stilwell Grade School	Zoom Licenses	\$ 15.00	4.00	\$ 60.00	
35	Stilwell Grade School	iPads	\$ 410.00	40.00	\$ 16,400.00	
36	Stilwell Grade School	iPad Case	\$ 27.00	40.00	\$ 1,080.00	
37	Stilwell Grade School	Secure Storage Bins	\$ 330.00	4.00	\$ 1,320.00	
38	Stilwell Grade School	Apps	\$ 10.00	40.00	\$ 400.00	
39	Stilwell Grade School	Teacher Computer	\$ 1,027.00	4.00	\$ 4,108.00	
40	Stilwell Grade School	Classroom Computers	\$ 1,350.00	4.00	\$ 5,400.00	
41	Stilwell Grade School	Smartboard	\$ 6,000.00	4.00	\$ 24,000.00	
42	Stilwell Grade School	HDMI Cable	\$ 17.00	4.00	\$ 68.00	
43	Stilwell Grade School	Classroom Cameras	\$ 1,300.00	4.00	\$ 5,200.00	
44	Stilwell Grade School	Mounting Kit for Camera	\$ 150.00	8.00	\$ 1,200.00	
45	Stilwell Grade School	Electrical	\$ 300.00	4.00	\$ 1,200.00	
46	Stilwell Grade School	Microphone	\$ 300.00	4.00	\$ 1,200.00	
47	Stilwell Grade School	USB extension for microphones	\$ 21.00	4.00	\$ 84.00	
48	Stilwell Grade School	USB extension for cameras	\$ 532.00	4.00	\$ 2,128.00	
49	Alex Elementary School	Zoom Licenses	\$ 15.00	4.00	\$ 60.00	
50	Alex Elementary School	iPads	\$ 410.00	40.00	\$ 16,400.00	
51	Alex Elementary School	iPad Case	\$ 27.00	40.00	\$ 1,080.00	
52	Alex Elementary School	Secure Storage Bins	\$ 330.00	4.00	\$ 1,320.00	
53	Alex Elementary School	Apps	\$ 10.00	40.00	\$ 400.00	
54	Alex Elementary School	Teacher Computer	\$ 1,027.00	4.00	\$ 4,108.00	
55	Alex Elementary School	Classroom Computers	\$ 1,350.00	4.00	\$ 5,400.00	
56	Alex Elementary School	Smartboard	\$ 6,000.00	4.00	\$ 24,000.00	
57	Alex Elementary School	HDMI Cable	\$ 17.00	4.00	\$ 68.00	
58	Alex Elementary School	Classroom Cameras	\$ 1,300.00	4.00	\$ 5,200.00	
59	Alex Elementary School	Mounting Kit for Camera	\$ 150.00	8.00	\$ 1,200.00	
60	Alex Elementary School	Electrical	\$ 300.00	4.00	\$ 1,200.00	

61	Alex Elementary School	Microphone	\$	300.00	4.00	\$	1,200.00			
62	Alex Elementary School	USB extension for microphones	\$	21.00	4.00	\$	84.00			
63	Alex Elementary School	USB extension for cameras	\$	532.00	4.00	\$	2,128.00			
		<b>Totals</b> \$ 242,714.00 \$							-	
Α	Overall DLT Project Budget (Sum of Total Grant/Cash column and In-Kind Match column)									
В	Less Proposed Cash Match (as documented on Leveraging Worksheet)									
С	Less Proposed In-Kind Match (From Total of In-Kind Match Column)									
D				DLT	۲ Grant R	eq	uest (A-B-C)	\$	211,054.00	
	Grant to Match % check (15% minimum req'd)									

## F. Financial Information and Sustainability

As demonstrated by the included Letter of Commitment from MACU's President, Dr. John Fozard in Tab D – Matching Requirements, MACU is requesting DLT grant funds in the amount of \$211,054 and will provide a Cash/In-Kind match of \$31,660 towards the ATOMS project \$242,714 cost. The availability of the matching funds can be seen in the included documentation.

ATOMS public school districts will have limited obligations for maintaining the technology as the school systems lack Directors of Technology. The systems will be designed to limit the amount of support needed.

The success and sustainability of the project will be based on whether multiple interactions are completed on a near daily basis during each ATOMS school districts' Academic Year. Site Coordinators and individual MACU mentors and faculty will log these interactions on a weekly basis.

There are no fees for service for MACU to provide these services to the ATOMS school districts. However, MACU anticipates two potential sources of revenue that result from this project. MACU views ATOMS as a source of a potential pipeline of students who may ultimately attend the institution. MACU's faculty and student connections are intended to raise awareness of the institution, which may lead to new growth of MACU's student population. Although ATOMS does not require any ATOMS student to pursue a degree at MACU, the project may increase awareness of an institution that serves the types of students who attend ATOMS elementary schools. Further, no exclusivity is required by the ATOMS school district to obtain STEM teaching and learning modules, which may result in school system investments in distance learning.

The ATOMS team also anticipates that the project may attract private donations from community businesses at both the Hub sites and End-User sites that have an interest in keeping STEM college graduates in regional job opportunities. As the project matures, development teams from MACU and the school district will coordinate outreach to business interests who may want advance this program in other school districts. The goal of this effort would be to maintain and procure equipment, and increase funds for operational needs such as teaching and course curriculum.

## **G: Statement of Experience**

MACU's distance learning aptitude began during its initial partnership with Jones International University in 2000, MACU went on to synchronously broadcast its adult degree completion degree programs to over 21 off-campus locations in Oklahoma utilizing interactive educational television. MACU had articulation agreements with several colleges such as Western Oklahoma State College, Redlands Community College, Carl Albert State College, Seminole State College, and Oklahoma State University. Dr. Vickie Hinkle, the Director of the ATOMS project, worked with two of these sites to teach education classes to distance learning students in 2008 and 2009, Articulation agreements were signed with eight technology centers including two military bases, Vance Air Force Base, and Fort Sill. The university also broadcast its classes to two outof-state locations, Kirtland Air Force Base in Albuquerque, New Mexico, and Otereo Junior College in La Junta, in Colorado.

By 2007, MACU was approved by The Higher Learning Commission: North Central Association of Colleges and Schools (HLC), to offer all Bachelor and Master's degree programs 100% online. In 2018, 81% of the university's student population take their course work online. The D2L platform provides synchronous and asynchronous instructional and communication tools. Therefore, Mid-America Christian University has a long history of providing quality education and instruction to students in remote locations. The Higher Learning Commission's peer review teams have also verified that the university has an experienced and adequate staff to support student help desk requests, as well as addressing any technology interruptions in educational services.

From its initial partnership with Jones International University in 2000, MACU went on to synchronously broadcast its adult degree completion programs to over 21 offcampus locations in Oklahoma utilizing interactive educational television.

Therefore, Mid-America Christian University has a long history of providing quality education and instruction to students in remote locations. Expanding these services to STEM education in high need, rural elementary schools is a natural extension of this experience. The Higher Learning Commission's peer review teams have also verified that the university has an experienced and adequate staff to support student help desk requests, as well as addressing any technology interruptions in educational services.

The ATOMS public schools are committed to providing a technology-rich learning environment that enhances, engages, and improves students' educational experiences while preparing them for the world they will experience in the future. These technology resources promote the critical thinking, problem solving, and communications skills which are required for students to become lifelong learners and productive citizens in a technologically complex, multicultural rich, and globally interdependent environment.

## **H:** Telecommunications System Plan

MACU's Chief Information Officer has worked with superintendents and IT personnel at remote sites to ensure all locations have a telecommunications systems plan in place to ensure a successful project. Over the course of the last month, each project partner has identified the critical infrastructure, links, and broadband capacity required to ensure that conferencing educational technology is operational at all four project sites.

To ensure the proper equipment is being used for the video conferencing, MACU personnel attended the Educause Conference in October 2018, a leading conference for educational technology professionals. MACU personnel also attended the Consumer Electronic Showcase in January 2019. Meetings with various technology vendors at the conferences allowed MACU to evaluate new technologies while speaking to vendors about the functionality and effectiveness of synchronous video technologies. Discussion also took place in Spring 2019 with SKC Communications, a leading video implementation partner in the educational space.

Unlike other systems, this TSP is not particularly complex because it entails limited connections at remote sites through commercial-off-the-shelf technology. The CIO is highly familiar with Apple, Zoom and other video technology, which has been used on related projects such as the university's IETV initiative to broadcast classes, serving as a global hub for online video conferencing of Bethel Series classes, and holding online classes for almost 20 years.

Different options were provided by engineers and vendors and with those discussions a solution was chosen. To ensure a successful learning video environment, 4K video was determined to be the standard. Video equipment from Logitech (960 Rally Camera) was chosen because of its high video quality, ease of use and ability to pan/tilt/zoom. This allows each student speaking to be seen on the camera to allow for a fully immersed discussion. The computers operating the streaming cameras were chosen from industry leaders Dell and Apple. Multiple vendors were selected for various remote sites to accommodate for their technology support abilities. The telecommunications system is purposely designed to require little ongoing support as to not burden the on-site IT staff. Zoom was chosen as the video conferencing software. This software was described as a leader in video conferencing software by Gartner in its 2018 report. Zoom also has a pricing agreement with the OneNet, a state provider of Internet to K-12 schools. This ensure the renewal pricing for the software is minimal in future years.

The TSP has reviewed broadband speeds, technology requirements, and all infrastructure connections. This coordination was completed between MACU's CIO and all locations confirmed the infrastructure was in place to support the video conferencing on all hardware. Bandwidths ranged from 500MB to 2GB in connection speed. All locations confirmed the presence of wireless Internet, except for MACU did not have classroom specific wireless. This has been addressed in the hardware of the grant. As part of the interactive video equipment, SmartBoard 6070 model screens have been selected to allow 3-6<sup>th</sup> grade students to diagram on the monitors as they discuss STEM topics.

Alex Public Schools purchased similar boards in the last two years so they are equipped for video broadcast. All other sites will need these 4K monitors.

Each of the End-User sites has a combination of adequate (but upgradeable) equipment, aging equipment, or no technology in place. In the case of Alex Public Schools, the display monitors are two years old and sufficient to meet the needs of the video conferencing, so new monitors will not be purchased. The other two End-User sites have aging equipment, which is not reliable, and new SmartBoards will replace this aging equipment. All sites have either older classroom computers or computers not powerful enough to handle the video conferencing software and related applications at the quality to provide for a successful program. The equipment will provide new, powerful computers to ensure high quality streaming. None of the sites have video conferencing cameras or iPads in these classrooms. These will be purchased new for the sites. A map of how ATOMS Distance Learning Services is provided below:



Access to Online Math and Science (ATOMS) Project

Mid-America Christian University (MACU)—Pure Hub Site, Oklahoma City, OK

- Peggs Public Schools—End-User, Peggs CDP, Cherokee County, OK
- Alex Public Schools—End-User, Town of Alex, Grady County, OK
- Stilwell Public Schools—End-User, City of Stilwell, Adair County, OK

Site addresses for all sites in the preceding map are contained in the Site Worksheet and below:

Site and Project Role

Site	Site Role
Mid-America Christian University	Hub
3500 S.W 119th Street	
Oklahoma City, OK 73170	
Peggs Public School	End-User
10821 Hickory Ave, Peggs, OK 74452''	
Alex Public Schools	End-User
209 South 2nd Street,	
Alex, OK 73002	
Stilwell Public Schools	End-User
1801 W. Locust Street	
Stilwell OK 74960	

Equipment required for this project is included in the Budget Worksheet as shown on the following page.

# **Budget Worksheet**

(Insert additional rows as needed)

				Extend	ed Cost	
Line Item				# of	Grant or Cash	
#	Site Name	Description	Unit Cost	Units	Match funds	In-Kind Match
1	MACU	Zoom Licenses	\$ 4.00	20.00	\$ 80.00	
2	MACU	iPads	\$ 650.00	20.00	\$ 13,000.00	
3	MACU	iPad Case	\$ 27.00	20.00	\$ 540.00	
4	MACU	Apple Pencil	\$ 90.00	20.00	\$ 1,800.00	
5	MACU	Secure Storage Bins	\$ 750.00	1.00	\$ 750.00	
6	MACU	Apps	\$ 10.00	20.00	\$ 200.00	
7	MACU	Teacher Computer	\$ 1,700.00	4.00	\$ 6,800.00	
8	MACU	Classroom Computers	\$ 1,500.00	4.00	\$ 6,000.00	
9	MACU	Smartboard	\$ 6,000.00	4.00	\$ 24,000.00	
10	MACU	HDMI Cable	\$ 17.00	4.00	\$ 68.00	
11	MACU	Classroom Cameras	\$ 1,300.00	8.00	\$ 10,400.00	
12	MACU	Mounting Kit for Camera	\$ 150.00	8.00	\$ 1,200.00	
13	MACU	Electrical	\$ 300.00	4.00	\$ 1,200.00	
14	MACU	Microphone	\$ 300.00	4.00	\$ 1,200.00	
15	MACU	USB extension for microphones	\$ 21.00	4.00	\$ 84.00	
16	MACU	USB extension for cameras	\$ 532.00	4.00	\$ 2,128.00	
17	MACU	Document Camera	\$ 250.00	2.00	\$ 500.00	
18	MACU	Wireless Access Points	\$ 1,245.00	4.00	\$ 4,980.00	
19	MACU	Wireless Access License	\$ 60.00	4.00	\$ 240.00	
20	Alex Elementary School	Zoom Licenses	\$ 15.00	4.00	\$ 60.00	
21	Alex Elementary School	iPads	\$ 410.00	40.00	\$ 16,400.00	
22	Alex Elementary School	iPad Case	\$ 27.00	40.00	\$ 1,080.00	
23	Alex Elementary School	Secure Storage Bins	\$ 330.00	4.00	\$ 1,320.00	
24	Alex Elementary School	Apps	\$ 10.00	40.00	\$ 400.00	
25	Alex Elementary School	Teacher Computer	\$ 1,027.00	4.00	\$ 4,108.00	
26	Alex Elementary School	Classroom Computers	\$ 1,350.00	4.00	\$ 5,400.00	
27	Alex Elementary School	HDMI Cable	\$ 17.00	4.00	\$ 68.00	

28	Alex Elementary School	Classroom Cameras	\$ 1,300.00	4.00	\$ 5,200.00	
29	Alex Elementary School	Mounting Kit for Camera	\$ 150.00	8.00	\$ 1,200.00	
30	Alex Elementary School	Electrical	\$ 300.00	4.00	\$ 1,200.00	
31	Alex Elementary School	Microphone	\$ 300.00	4.00	\$ 1,200.00	
32	Alex Elementary School	USB extension for microphones	\$ 21.00	4.00	\$ 84.00	
33	Alex Elementary School	USB extension for cameras	\$ 532.00	4.00	\$ 2,128.00	
34	Stilwell Grade School	Zoom Licenses	\$ 15.00	4.00	\$ 60.00	
35	Stilwell Grade School	iPads	\$ 410.00	40.00	\$ 16,400.00	
36	Stilwell Grade School	iPad Case	\$ 27.00	40.00	\$ 1,080.00	
37	Stilwell Grade School	Secure Storage Bins	\$ 330.00	4.00	\$ 1,320.00	
38	Stilwell Grade School	Apps	\$ 10.00	40.00	\$ 400.00	
39	Stilwell Grade School	Teacher Computer	\$ 1,027.00	4.00	\$ 4,108.00	
40	Stilwell Grade School	Classroom Computers	\$ 1,350.00	4.00	\$ 5,400.00	
41	Stilwell Grade School	Smartboard	\$ 6,000.00	4.00	\$ 24,000.00	
42	Stilwell Grade School	HDMI Cable	\$ 17.00	4.00	\$ 68.00	
43	Stilwell Grade School	Classroom Cameras	\$ 1,300.00	4.00	\$ 5,200.00	
44	Stilwell Grade School	Mounting Kit for Camera	\$ 150.00	8.00	\$ 1,200.00	
45	Stilwell Grade School	Electrical	\$ 300.00	4.00	\$ 1,200.00	
46	Stilwell Grade School	Microphone	\$ 300.00	4.00	\$ 1,200.00	
47	Stilwell Grade School	USB extension for microphones	\$ 21.00	4.00	\$ 84.00	
48	Stilwell Grade School	USB extension for cameras	\$ 532.00	4.00	\$ 2,128.00	
49	Alex Elementary School	Zoom Licenses	\$ 15.00	4.00	\$ 60.00	
50	Alex Elementary School	iPads	\$ 410.00	40.00	\$ 16,400.00	
51	Alex Elementary School	iPad Case	\$ 27.00	40.00	\$ 1,080.00	
52	Alex Elementary School	Secure Storage Bins	\$ 330.00	4.00	\$ 1,320.00	
53	Alex Elementary School	Apps	\$ 10.00	40.00	\$ 400.00	
54	Alex Elementary School	Teacher Computer	\$ 1,027.00	4.00	\$ 4,108.00	
55	Alex Elementary School	Classroom Computers	\$ 1,350.00	4.00	\$ 5,400.00	
56	Alex Elementary School	Smartboard	\$ 6,000.00	4.00	\$ 24,000.00	
57	Alex Elementary School	HDMI Cable	\$ 17.00	4.00	\$ 68.00	
58	Alex Elementary School	Classroom Cameras	\$ 1,300.00	4.00	\$ 5,200.00	
59	Alex Elementary School	Mounting Kit for Camera	\$ 150.00	8.00	\$ 1,200.00	
60	Alex Elementary School	Electrical	\$ 300.00	4.00	\$ 1,200.00	

61	Alex Elementary School	Microphone	\$	300.00	4.00	\$	1,200.00			
62	Alex Elementary School	USB extension for microphones	\$	21.00	4.00	\$	84.00			
63	Alex Elementary School	USB extension for cameras	\$	532.00	4.00	\$	2,128.00			
					Totals	\$	242,714.00	\$	-	
Α	A Overall DLT Project Budget (Sum of Total Grant/Cash column and In-Kind Match column)									
В	B Less Proposed Cash Match (as documented on Leveraging Worksheet)									
С	C Less Proposed In-Kind Match (From Total of In-Kind Match Column)									
D	DLT Grant Request (A-B-C)									
Grant to Match % check (15% minimum req'd)									15.00%	

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# I. Compliance with Other Federal Statutes

The following pages include all required federal certifications.

Position 3

USDA Form RD 400-4 (Rev. 11-17)

ASSURANCE AGREEMENT (Under Title VI, Civil Rights Act of 1964) FORM APPROVED OMB No. 0575-0018 OMB No. 0570-0062

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Mid-America Christian University

(name of recipient)

3500 S.W 119th Street Oklahoma City, OK 73170

(address)

As a condition of receipt of Federal financial assistance, you acknowledge and agree that you must comply (and require any subgrantees, subrecipients, contractors, successors, transferees, and assignees to comply) with applicable provisions of national laws and policies prohibiting discrimination, including but not limited to:

1. Title VI of the Civil Rights Act of 1964, as amended, which prohibits you from discriminating on the basis of race, color, or national origin (42 U.S.C. 2000d et seq.), and 7 CFR Part 15, 7 CFR 1901, Subpart E.

As clarified by Executive Order 13166, Improving Access to Services for Persons with Limited English Proficiency, and resulting agency (Rural Housing Service, Rural Business and Cooperative Service, and Rural Utilities Service) guidance, national origin discrimination includes discrimination on the basis of limited English proficiency (LEP). To ensure compliance with Title VI, you must take reasonable steps to ensure that LEP persons have meaningful access to your programs [in accordance with USDA RD LEP Guidance for RD Funded (Assisted) Programs]. Meaningful access may entail providing language assistance services, including oral and written translation, where necessary. You are encouraged to consider the need for language services for LEP persons served or encountered both in developing your budgets and in conducting your programs and activities. For assistance and information regarding your LEP obligations, go to <a href="http://www.lep.gov">http://www.lep.gov</a>;

2. Title IX of the Education Amendments of 1972, as amended, which prohibits you from discriminating on the basis of sex in education programs or activities (20 U.S.C. 1681 et seq.)[as implemented by 7 CFR Part 15, 7 CFR 1901, Subpart E];

3. The Age Discrimination Act of 1975, as amended, which prohibits you from discriminating on the basis of age (42 U.S.C. 6101 et seq.) [as implemented by 7 CFR Part 15, 7 CFR 1901, Subpart E];

4. Section 504 of the Rehabilitation Act of 1973, as amended, which prohibits you from discriminating on the basis of disability (29 U.S.C. 794) [as implemented by 7 CFR Part 15, 7 CFR Part 15b, 7 CFR 1901, Subpart E];

5. Title VIII of the Civil Rights Act, which prohibits you from discriminating in the sale, rental, financing, and advertising of dwellings, or in the provision of services in connection therewith, on the basis of race, color, national origin, religion, disability, familial status, and sex (42 U.S.C. 3601 et seq.), as implemented by the Department of Housing and Urban Development at 24 CFR part 100. The prohibition on disability discrimination includes the requirement that new multifamily housing with four or more dwelling units, i.e., the public and common use areas and individual apartment units (all units in buildings with elevators and ground-floor units in buildings without elevators) be designed and constructed with certain accessible features, see 24 CFR Part 100.201; and

6. Titles II and III of the Americans with Disabilities Act, which prohibit you from discriminating on the basis of disability in the operation of public entities, public and private transportation systems, places of public accommodation, and certain testing entities (42 U.S.C. §§ 12131-12189), as implemented by Department of Justice regulations at 28 C.F.R. parts 35 and 36, and 7 CFR Part 15, 7 CFR Part 15b, 7 CFR 1901, Subpart E.

According to the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number. The valid OMB control number for this information collection is 0575-0018. The time required to complete this information is estimated to average 15 minutes per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information.

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You also acknowledge and agree that you must comply (and require any subgrantees, subrecipients, contractors, successors, transferees, and assignees to comply) with applicable provisions governing USDA Rural Development (Rural Housing Service, Rural Business and Cooperative Service, and Rural Utilities Service) access to records, accounts, documents, information, facilities, and staff:

- 1. You must cooperate with any compliance review or complaint investigation conducted by USDA Rural Development (Rural Housing Service, Rural Business and Cooperative Service, and Rural Utilities Service).
- 2. You must give USDA Rural Development (Rural Housing Service, Rural Business and Cooperative Service, and Rural Utilities Service) access to and the right to examine and copy records, accounts, and other documents and sources of information related to the grant and permit access to facilities, personnel, and other individuals and information as may be necessary, as required by Title VI, Title IX, Age, and Section 504 implementing regulations and other applicable laws or program guidance.
- 3. You must keep such records and submit to the responsible Department official or designee timely, complete, and accurate compliance reports at such times, and in such form and containing such information, as the responsible Department official or his designee may determine to be necessary to ascertain whether you have complied or are complying with relevant obligations.
- 4. You must comply with all other reporting, data collection, and evaluation requirements, as prescribed by law or detailed in program guidance.
- 5. Make available to users, participants, beneficiaries and other interested persons such information regarding the provisions of this agreement and the regulations, and in such manner as the Rural Development or the U.S. Department of Agriculture finds necessary to inform such persons of the protection assured them against discrimination.
- 6. If, during the past three years, you (the recipient) have been accused of discrimination on the grounds of race, color, national origin (including limited English proficiency), sex, age, disability, religion, or familial status, you must provide a list of all such proceedings, pending or completed, including outcome and copies of settlement agreements.
- 7. In the event any court or administrative agency makes a finding of discrimination on grounds of race, color, national origin (including limited English proficiency), sex, age, disability, religion, or familial status against you, or you settle a case or matter alleging such discrimination, you must forward a copy of the complaint and findings to USDA Rural Development (Rural Housing Service, Rural Business and Cooperative Service, and Rural Utilities Service), Office of Civil Rights.

The United States has the right to seek judicial enforcement of these obligations.

You also acknowledge and agree that you must comply (and require any subgrantees, subrecipients, contractors, successors, transferees, and assignees to comply) with applicable provisions of program-specific nondiscrimination policy requirements found at CFR Part 15, 7 CFR Part 15 b, 12 CFR Part 202, 7 CFR 1901, Subpart E., DR4300-003, DR4330-0300, DR4330-005.

### Period of Obligation

In the case of any service, financial aid, covered employment, equipment, property, or structure provided, leased, or improved with federal assistance extended to the Recipient by Rural Development (Rural Housing Service, Rural Business and Cooperative Service, and Rural Utilities Service), this assurance obligates the Recipient for the period during which federal assistance is extended. In the case of any transfer of such service, financial aid, equipment, property, or structure, this assurance obligates the transferee for the period during which federal assistance is extended. If any personal property is so provided, this assurance obligates the Recipient for the period during which it retains ownership or possession of the property. In all other cases, this assurance obligates the Recipient for the period during which the federal assistance is extended to the Recipient by Rural Development (Rural Housing Service, Rural Business and Cooperative Service, and Rural Utilities Service).

### Employment Practices

Where a primary objective of the federal assistance is to provide employment or where the Recipient's employment practices affect the delivery of services in programs or activities resulting from federal assistance extended by Rural Development (Rural Housing Service, Rural Business and Cooperative Service, and Rural Utilities Service), the Recipient agrees not to discriminate on the grounds of race, color, national origin, sex, age, or disability, in its employment practices. Such employment practices may include, but are not limited to, recruitment, advertising, hiring, layoff or termination, promotion, demotion, transfer, rates of pay, training and participation in upward mobility programs; or other forms of compensation and use of facilities.

### Data Collection

The Recipient agrees to compile and maintain information pertaining to programs or activities developed as a result of the Recipient's receipt of federal assistance from Rural Development (Rural Housing Service, Rural Business and Cooperative Service, and Rural Utilities Service). Such information shall include, but is not limited to the following: (1) the manner in which services are or will be provided and related data necessary for determining whether any persons are or will be denied such services on the basis of prohibited discrimination; (2) the population eligible to be served by race, color, national origin, sex, age, and disability; (3) data regarding covered employment including use or planned use of bilingual public contact employees serving beneficiaries of the program where necessary to permit effective participation by beneficiaries unable to speak or understand English; (4) the location of existing or proposed facilities connected with the program and related information adequate for determining whether the location has or will have the effect of unnecessarily denying access to any person on the basis of prohibited discrimination; (5) the present or proposed membership by race, color, national origin, sex, age and disability in any planning or advisory body which is an integral part of the program; and (6) any additional written data determined by Rural Development (Rural Housing Service, Rural Business and Cooperative Service, and Rural Utilities Service) to be relevant to the obligation to assure compliance by recipients with laws cited in this assurance agreement.

Under penalty of perjury, the undersigned officials certify that they have read and understand their obligations as herein described, that the information submitted in conjunction with this Document is accurate and complete, and that the recipient is in compliance with the nondiscrimination requirements set out above.

Rights and remedies provided for under this agreement shall be cumulative.

In witness whereof,

Mid-America Christian University (name of recipient)

on this

date has caused this agreement to be executed by its duly authorized officers and its seal affixed hereto, or, if a natural person, has hereunto executed this agreement.

(SEAL)

Mier Santin CFO + Sec. Freasuren

Recipient May 1, 2019 Date

Title

This form is available electronically.

employer.



# Instructions for Certification

- (1) By signing and submitting this form, the prospective primary participant is providing the certification set out on page 1 in accordance with these instructions.
- (2) The inability of a person to provide the certification required below will not necessarily result in denial of participation in this covered transaction. The prospective participant shall submit an explanation of why it cannot provide the certification set out on this form. The certification or explanation will be considered in connection with the department or agency's determination whether to enter into this transaction. However, failure of the prospective primary participant to furnish a certification or an explanation shall disqualify such person from participation in this transaction.
- (3) The certification in this clause is a material representation of fact upon which reliance was placed when the department or agency determined to enter into this transaction. If it is later determined that the prospective primary participant knowingly rendered an erroneous certification, in addition to other remedies available to the Federal Government, the department or agency may terminate this transaction for cause or default.
- (4) The prospective primary participant shall provide immediate written notice to the department or agency to which this proposal is submitted if at any time the prospective primary participant learns that its certification was erroneous when submitted or has become erroneous by reason of changed circumstances.
- (5) The terms "covered transaction," "debarred," "suspended," "ineligible," "lower tier covered transaction," "participant," "person," "primary covered transaction," "principal," "proposal," and "voluntarily excluded," as used in this clause, have the meanings set out in the Definitions and Coverage sections of the rules implementing Executive Order 12549, at 2 C.F.R. Parts 180 and 417. You may contact the department or agency to which this proposal is being submitted for assistance in obtaining a copy of those regulations.
- (6) The prospective primary participant agrees by submitting this form that, should the proposed covered transaction be entered into, it shall not knowingly enter into any lower tier covered transaction with a person who is debarred, suspended, declared ineligible, or voluntarily excluded from participation in this covered transaction, unless authorized by the department or agency entering into this transaction.
- (7) The prospective primary participant further agrees by submitting this form that it will include the clause titled "Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion - Lower Tier Covered Transactions," provided by the department or agency entering into this covered transaction, without modification, in all lower tier covered transactions and in all solicitations for lower tier covered transactions.
- (8) A participant in a covered transaction may rely upon a certification of a prospective participant in a lower tier covered transaction that is not debarred, suspended, ineligible, or voluntarily excluded from the covered transaction, unless it knows that the certification is erroneous. A participant may decide the method and frequency by which it determines the eligibility of its principals. Each participant may, but is not required to, check the System for Award Management (SAM) database.
- (9) Nothing contained in the foregoing shall be construed to require establishment of a system of records in order to render in good faith the certification required by this clause. The knowledge and information of a participant is not required to exceed that which is normally possessed by a prudent person in the ordinary course of business dealings.
- (10) Except for transactions authorized under paragraph (6) of these instructions, if a participant in a covered transaction knowingly enters into a lower tier covered transaction with a person who is suspended, debarred, ineligible, or voluntarily excluded from participation in this transaction, in addition to other remedies available to the Federal Government, the department or agency may terminate this transaction for cause or default.

This form is available electronically.

Form Approved – OMB No. 0505-0027 Expiration Date: 12/31/2018

AD-1049
s required by the 8101 et seq.), and on December 8, 2011, in ing the grant.
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	Taking one of the following actions, within 30 calendar days of receiving notice under subparagraph (A.4.b.), with respect to any employee who is so convicted –	
	a. Taking appropriate personnel action against such an employee, up to and including termination, consistent with the requirements of the Rehabilitation Act of 1973, as amended; or	
	<ul> <li>Requiring such employee to participate satisfactorily in a drug abuse assistance or rehabilitation program approved for such purposes by a Federal, State, or, local health, law enforcement, or other appropriate agency;</li> </ul>	
	. Making a good faith effort to continue to maintain a drug-free workplace through implementation of paragraphs (A.1. through A.6.).	5
В.	he grantee may insert in the space provided below the site(s) for the performance of work done in connection with ne specific grant:	
PLAC	America Christian University, 3500 SW119454. OKlahoma City OK 73170	
Check	] if there are workplaces on file that are not identified here.	
ORG	zation NAME d - America Christian University Inc	NAME
NAM	) AND TITLE(S) OF AUTHORIZED REPRESENTATIVE(S)	
SIGN	URE(S) Mice Sader DATE 5/8/2019	7

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# Instructions for Certification

- (1) By signing and submitting this form, the grantee is providing the certification set out on pages one and two in accordance with these instructions.
- (2) The certification set out on pages one and two is a material representation of fact upon which reliance is placed when the agency awards the grant. If it is later determined that the grantee knowingly rendered a false certification, or otherwise violates the requirements of the Drug-Free Workplace Act, the agency, in addition to any other remedies available to the Federal Government, may take action authorized under the Drug-Free Workplace Act.
- (3) Workplaces under grants, for grantees other than individuals, need not be identified on the certification. If known, they may be identified in the grant application. If the grantee does not identify the workplaces at the time of application, or upon award, if there is no application, the grantee must keep the identity of the workplace(s) on file in its office and make the information available for Federal inspection. Failure to identify all known workplaces constitutes a violation of the grantee's drug-free workplace requirements.
- (4) Workplace identifications must include the actual address of buildings (or parts of buildings) or other sites where work under the grant takes place. Categorical descriptions may be used (e.g., all vehicles of a mass transit authority or State highway department while in operation, State employees in each local unemployment office, performers in concert halls or radio studios).
- (5) If the workplace identified to the agency changes during the performance of the grant, the grantee shall inform the agency of the change(s). If it previously identified the workplaces in question, see paragraph (3) above.
- (6) Definitions of terms in the Nonprocurement Suspension and Debarment common rule and Drug-Free Workplace common rule apply to this certification. Grantees' attention is called, in particular, to the following definitions from these rules:
  - "Controlled substance" means a controlled substance in Schedules 1 through V of the Controlled Substances Act, 21 U.S.C. § 812, and as further defined by 21 C.F.R. §§ 1308.11-1308.15.
  - "Conviction" means a finding of guilt (including a plea of nolo contendere) or imposition of sentence, or both, by any judicial body charged with the responsibility to determine violations of the Federal or State criminal drug statutes.
  - "Criminal drug statute" means a Federal or non-Federal criminal statute involving the manufacture, distribution, dispensing, use, or possession of any controlled substance.
  - "Employee" means the employee of a grantee directly engaged in the performance of work under a grant, including: (i) all "direct charge" employees (ii) all "indirect charge" employees unless their impact or involvement is insignificant to the performance of the grant and, (iii) temporary personnel and consultants who are directly engaged in the performance of work under the grant and who are on the grantee's payroll. This definition does not include workers not on the payroll of the grantee (e.g., volunteers, even if used to meet a matching requirement, consultants or independent contractors not on the grantee's payroll, or employees of subrecipients or subcontractors in covered workplaces).

AD-30	30-Y AN	U.S. DEPARTMENT OF AGRICULTURE REPRESENTATIONS REGARDING FELONY CONVICTION ID TAX DELINQUENT STATUS FOR CORPORATE APPLI FY 2012, FY 2013, (FY 2014 Continuing Resolution Mon	ON CANTS ies)
Note:	You only need to complete that has filed articles of it United States including A Islands, Puerto Rico, Re- include both for profit an The following statement is mad- information for USDA Agencies Agencies Appropriations Act, 2 concerning entity conviction of According to the Paperwork Re- information unless it displays a required to complete this infor- searching existing data source	ete this form if you are a corporation. A corporation include incorporation in one of the 50 States, the District of Columbi American Samoa, Federated States of Micronesia, Guam, Mi public of Palau, Republic of the Marshall Islands, or the U.S and non-profit entities. de in accordance with the Privacy Act of 1974 (5 U.S.C. 552(a), as amended s and staff offices is in §738 and 739 of the Agriculture, Rural Development, 2012, P.L. 112-55, as amended and/or subsequently enacted. The informat a felony criminal violation, and/or unpaid Federal tax liability status. eduction Act of 1985 an agency may not conduct or sponsor, and a person a valid OMB control number. The valid OMB control number for this informa- mation collection is estimated to average 15 minutes per response, including res, gathering and maintaining the data needed, and completing and reviewing	s, but is not limited to, any entity a, or the various territories of the idway Islands, Northern Mariana . Virgin Islands. Corporations d). The authority for requesting the following Food and Drug Administration, and Related ion will be used to confirm applicant status is not required to respond to a collection of tion collection is 0505-0025. The time g the time for reviewing instructions, ig the collection of information.
1. APPL Mid-An	LICANT'S NAME nerica Christian University	2. APPLICANT'S ADDRESS (Including Zip Code) 3500 S.W 119th Street Oklahoma City, OK 73170	3. TAX ID NO. (Last 4 digits) 6134.

- 4A. Has the Applicant been convicted of a felony criminal violation under Federal or State law in the 24 months preceding the date of application? YES X NO
- 4B. Has any officer or agent of Applicant been convicted of a felony criminal violation for actions taken on behalf of Applicant under Federal or State law in the 24 months preceding the date of application? YES X NO
- 4C. Does the Applicant have any unpaid Federal tax liability that has been assessed, for which all judicial and administrative remedies have been exhausted or have lapsed, and that is not being paid in a timely manner pursuant to an agreement with the authority responsible for collecting the tax liability? YES X NO

Providing the requested information is voluntary. However, failure to furnish the requested information will make the applicant ineligible to enter into a contract, memorandum of understanding, grant, loan, loan guarantee, or cooperative agreement with USDA.

PART B - SIGNATURE		
5A. APPLICANT'S SIGNATURE (BY)	5B. TITLE/RELATIONSHIP OF THE INDIVIDUAL IF SIGNING IN A REPRESENTATIVE CAPACITY	5C. DATE SIGNED (MM-DD-YYYY)
Mici Sarti	CFO ! Secretory Freasurer_	May 1, 2019

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AD-30	30	U.S. DEPARTMENT OF AGRICULTURE	
	AN	REPRESENTATIONS REGARDING FELONY CONVICTION D TAX DELINQUENT STATUS FOR CORPORATE APPLIC	ON CANTS
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- 4A. Has the Applicant been convicted of a felony criminal violation under any Federal law in the 24 months preceding the date of application? YES X NO
- 4B. Does the Applicant have any unpaid Federal tax liability that has been assessed, for which all judicial and administrative remedies have been exhausted or have lapsed, and that is not being paid in a timely manner pursuant to an agreement with the authority responsible for collecting the tax liability?  $\Box$  YES  $\Box$  NO

Providing the requested information is voluntary. However, failure to furnish the requested information will make the applicant ineligible to enter into a contract, memorandum of understanding, grant, loan, loan guarantee, or cooperative agreement with USDA.



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Section	Description	Schedule	Complet
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	C-1 Rurality		<b>√</b>
	C-2 Economic Need		6
	C-3 Special Consideration		
	C-4 Need for Services and Benefits		
D	Matching Requirements		0
B	Scope of Work		V
	1 - Specific Activities to be performed		8
	2 Who will carry out activities		
	3 - 1 metrames for accomplianing objectives		
	4 - Budget for all capital expenditures		0
F	Financial Information and Sustainability		-
G	Statement of Experience		W
н	Telecommunications Systems Plan		
	I - Capabilities & Description of Telecommunications Equipment	_	~
	2 - Complete Listing of all Telecommunications Equipment.		~
	3 - Description of the consultations with telecommunications carriers.		₽⁄
	4 - A diagram or map of the proposed system overlaid with a	Sec. 18	~
	geographic map of the service area 5. Sites (bub, hublend stors, or end-stors that will numbring in		
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J	Evidence Of Legal Existence and Authority to Contract with the Federal Government		~
ĸ	Environmental Impact and Historic Preservation		Đ
	Environmental Impact Survey		-
	Environmental Questionnaire		6
-	Completing with State Dimeter		~

FY2019 DLT- Application Checklist

By signing this checklist, you are certifying you understand by submitting the application you have enclosed each of the following required documents: [-1, J-2, I-4 and I-9. I-9 is only required for Corporate Entities. By signing this certification, you are agreeing to the language in schedules I-3, I-5, I-6 I-7, I-8 and II0, as shown in the application guide. To the extent any certification requires a question to be answered, please address your answer as a narrative attachment to this checklist. (I-5 and I-6 have questions that need to be answered, please attach an explanation to this checklist as to which selections you are making). If you have any questions about your application, please contact RUS prior to submitting this application and certification.

Mas ·C arti Print Name 0-dUl arha Signature Title Date

# J. Evidence of Legal Authority and Existence

Evidence of Legal Authority to receive federal grants follows on the next page, and evidence of legal existence is also in this section.



#### HELP MY SAM SE ARCH RECORDS DATA ACCESS CHECK STATUS ABOUT

ALERT: June 11, 2018: Entities registering in SAM must submit a notarized letter appointing their authorized Entity Administrator. Read our updated FAQs to learn more about changes to the notarized letter review process and other system improvements.

ALERT: SAM.gov will be down for scheduled maintenance Saturday, 05/11/2019, from 8:00 AM to 1:00 PM (EDT).

ALERT: CAGE is corrently experiencing a high volume of registrations, and is working them in the order in which they are received. When your registration is assigned to a CAGE Λ Technician, you will be contacted by CAGE, if necessary, for any additional information.

Entity Dashboard	M D AMERICA CHRISTIAN UNIVERSITY DUNS: 073922775 CAGE Code: 1S1P7 Status: Active	3500 SW 119TH ST OKLAHOMA CITY, OK, 73170-4504 , UNITED STATES
Entity Overview	Purpose of Registration: Federal Assistance Awards Only	
Entity Registration	Entity Overview	
<u>Core Data</u>		
<u>Assertions</u>		
<u>Reps &amp; Certs</u>	Entity Registration Summary	
POCs	DUNS: 073922775 Name: MID AMERICA CHRISTIAN UNIVERSITY	
Reports	Business Type: Business or Organization	
Service Contract	Last Updated By: Mici Sarlin Registration Status: Active	
Report	Activation Date: 01/31/2019	
<u>BioPreferred Report</u>	Espiration Date: 01/31/2020	
Exclusions		
Active Exclusions	Exclusion Sammary	
Inactive Exclusions	Active Exclusion Records? No	
<ul> <li>Excluded Family</li> <li>Members</li> </ul>		
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# **Entity Summary Information**

Select the buttons below to file or place an order.

To view Entity Details there will be a \$5.00 charge and you will need to click on **VIEW ENTITY DETAILS** button at the bottom of the page.

If you are ordering documents such as a "Certificate of Good Standing" or "copies" you will need to click on the ORDER DOCUMENTS button at the bottom of the page.

If you are filing a legal document such as a trade name, amendment, annual certificate, etc., you will need to click on **FILE A DOCUMENT** button at the bottom of the page.

#### MID-AMERICA CHRISTIAN UNIVERSITY, INC.

Effective

Address:

View Entity Detail

City, State , ZipCode:

File a Document

iling Number:	2112043742
lame Type:	Legal Name
tatus:	
	In Existence
orp type:	Domestic Not For Profit Corporation
urisdiction:	Oklahoma
ormation Date:	26 Jul 2004
egistered Agent I	nformation

26 Jul 2004

Order Documents

211 N ROBINSON 10TH FL

New Search

OKLAHOMA CITY OK 73102

64



# RESTATED CERTIFICATE OF INCORPORATION

WHEREAS, the Restated Certificate of Incorporation of

# MID-AMERICA CHRISTIAN UNIVERSITY, INC.

has been filed in the office of the Secretary of State as provided by the laws of the State of Oklahoma.

NOW THEREFORE, I, the undersigned, Secretary of State of the State of Oklahoma, by virtue of the powers vested in me by law, do hereby issue this certificate evidencing such filing.

IN TESTIMONY WHEREOF, I hereunto set my hand and cause to be affixed the Great Seal of the State of Oklahoma.



Filed in the city of Oklahoma City this <u>10th</u> day of <u>September, 2007</u>.

M. husan Javage

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Secretary of State

# K. Environmental Impact and Historic Preservation

Neither Mid-America Christian University (MACU), nor its Public School partner sites in Peggs, Stilwell or Alex anticipates any significant environment or historic preservation impact resulting from the proposed Access To Online Math and Science (ATOMS) project. This project entails the purchase of commercial off the shelf technology to connect MACU as a Hub provider of STEM education to three public schools. No new construction or modifications to the natural environment are required to carry out this project. No local, state or nationally recognized historic sites are included in this project

Environmental impacts include the manufacture of new technology that is required for the development of technology. Some out of date equipment may be placed in a solid waste facility or recycled where possible.

No historic or archeological sites are part of this project, and only minor internal wiring changes may be required to implement the project at current non-historic sites.

L. Consultation with USDA State Director and State Strategic Plan Conformity


Business & Cooperative Programs 100 USDA, Ste. 108 Stillwater, OK 74074 Voice (405) 742-1060 Fax (855) 423-4044

May 13, 2019

Vickie Hinkle, PhD Director of Student Teaching Director of Field Experience Mid-America Christian University 3500 SW 119<sup>th</sup> Oklahoma City, OK 73170

Dear Dr. Hinkle:

I am pleased to support Mid-America Christian University with their Distance Learning and Telemedicine grant application.

This project, Access To Online Math and Science, will allow MACU to improve teaching, learning and the self-efficacy of students and teachers in STEM courses through synchronized distance learning for students in grades 3-6 in three rural elementary schools. The ATOMS project will provide these courses to approximately 600 students at the end-user sites along with providing professional development to twenty teachers.

This proposal appears to target and emphasize funds for a critical need and if funded would provide much needed access to STEM courses in these rural elementary schools.

There are limited sources of funding for distant learning and telecommunications projects, however Rural Development may offer an alternative source of funds through the Community Facilities loan and grant program.

Should you have any questions, please contact Amy Cowley at 405-742-1039.

Sincerely,

Lee R. Denney State Director - Oklahoma

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If you wish to file a Civil Rights program complaint of discrimination, complete the USDA Program Discrimination Complaint Form (PDF), found online at http://www.ascr.usda.gov/complaint\_filing\_cust.html. or at any USDA office, or call (866) 632-9992 to request the form. You may also write a letter containing all of the information requested in the form. Send your completed complaint form or letter to us by mail at U.S. Department of Agriculture, Director, Office of Adjudication, 1400 Independence Avenue, S W., Washington, D.C. 20250-9410, by fax (202) 690-7442 or email at program.intake@usda.gov. Revised 07.15.2016

## **PROJECT DESCRIPTION**

## a. Results from Prior NSF Support

Mid-America Christian University (MACU) faculty has not previously been awarded a National Science Foundation grant. However, the Principal Investigator (PI) for this NSF Scholarships in STEM (S-STEM) project, Dr. Harold Kihega, was selected in March 2019 to serve a 3-year term as a co-director of the Minority Institution Research Collaborative (MIRC), which has enjoyed significant NSF support per current and pending documentation. MIRC has engaged more than 300 students over the past decade, 80% of whom are individuals from historically underrepresented groups (IHUGS). MIRC has seen the largest number (percentage-wise) of IHUGS students, especially Native American students, transition from undergraduate experiences to graduate and professional experiences, which aligns with the goals of this proposal.

## b. Project Objectives and Plans

This proposal, Co-Curricular Activities Promoting Scholarship in Mathematics and Science (CAPS), investigates the use of scholarships and multiple, simultaneous cocurricular interventions as academic support activities that enhance student engagement, build motivation, increase persistence, and promote success for academically talented, low income first-generation, underrepresented groups (URG's) including women, African Americans, Latinos, and American Indians (AI's) interested in completing an Mathematics Biology degree. In Reflections undergraduate or on Student Persistence (Tinto, 2017), the author makes the observation that "one does not hear students speak of being retained. They speak instead of persisting to degree completion.... Persistence...is another way of speaking of motivation." The primary goal of this proposal is to investigate various co-curricular interventions and ranking them in order of effectiveness for increasing the persistence and motivation of URGs, which will contribute to the growing body of evidence (Estrada, Hernandez and Schultz, 2018; Sandefur and Gordy, 2016; Goonewardene et al., 2016; Mau, Perkins and Mau, 2016) of activities that improve outcomes for math and biology majors. The effective University of California at Berkeley's Biology Scholars Program (BSP) will serve as an evidence-based model for Mid-America Christian University's (MACU) CAPS program. The research question driving this proposal is: Which co-curricular components that serve as academic support are significant predictors of URG success in Biology and Mathematics and are those predictors different by gender, ethnicity? A ranking system from most to least effective will be developed to evaluate trends in the data.

Mid-America Christian University (MACU) in Oklahoma City, Oklahoma will use qualitative and quantitative methods to determine if, and to what degree, various cocurricular interventions achieve the desired goals of promoting URG students' interest and success as Mathematics and Biology majors. This methodology may also indicate strength or weakness of each intervention, and thus suggest adaptations to future implementation of financial or academic supports to ensure better, or stronger, outcomes. "Co-curricular programs create engaging environments when they introduce activities or context that result in students meaningfully connecting to STEM content...[, which], can be effective in retaining interest and persistence.... (Estrada, 2014)." CAPS will build institutional capacity at MACU through four co-curricular interventions that include: offering peer and faculty mentoring; engaging interdisciplinary small group journal clubs for Mathematics and Biology majors; establishing Learning Communities, which will be new at MACU; and, providing support services to guide students through the application process of applying for professional graduate schools. The CAPS project team recognizes that a community of science students may share common coursework, but have different cultural and socioeconomic backgrounds. It also realizes that other universities use a variety of cocurricular activities to support URGs, yet they still graduate at a lower rate than their counterparts (NSC Research Center, 2017; Medina, 2015). Thus determining the most and least effective co-curricular activities for a variety of URG students is paramount. CAPS seeks to ascertain which activities provide better support for academic success, retention to graduate, and matriculation to graduate school.

MACU will seek to recruit students into CAPS from three primary groups: current Mathematics and Biology majors and three diverse schools in Oklahoma City. MACU has established formal partnerships to help recruit CAPS scholars as shown by the Letters of Commitment from: Santa Fe Public Charter Schools (SFPS), with a high school population of 720, which is 93 percent Latino, 52% female and 48% male; Oklahoma Public Schools Native American Student Services (NASS), which serves a population of nearly 14% American Indian (AI) students out of 46,000; and, Oklahoma City Community College (OCCC), where more than 43% of the student body of nearly 14,500 students are Hispanic and Black, as well as 5% American Indian. However, the MACU CAPS program will be open to all of MACU's Mathematics and Biology majors, but MACU will seek to focus scholarship resources on academically talented, economically disadvantaged students as demonstrated by financial need. CAPS will emphasize: 1) recruiting from the above mentioned partnerships and other organizations serving low-income first generation URGs; 2) providing financial, academic and social support for all CAPS scholars throughout their school career at MACU; and, 3) evaluating which co-curricular components are the most and least effective for URG success in Biology and Mathematics.

MACU's efforts to develop co-curricular activities and increase success for URGs as Mathematics and Biology majors through this project considers Tinto's (2017) article *Reflections on Student Persistence*, which focuses on three important concepts pertaining to overall student success, motivation and retention including: 1) Student self-efficacy is vulnerable, especially during the first year of school; 2) Early in their school career, students must have a sense of belonging, especially those of similar socioeconomic backgrounds; and, 3) Students must value the curriculum, which is especially important in gateway courses that occur early in a student's academic career.

This Track 1 Institutional Capacity Building initiative considers the University of California at Berkeley's Biology Scholars Program (BSP) as a guideline. The components used in the BSP model include: Academic support for lower-division courses in biology major; Academic and career seminar series; Social events; Access to on/off campus paid research opportunities; Academic and personal advising; Mentoring; Resources for critical transitions (high school to university academics and social adjustments, declaring a major, applying to graduate and professional school); and, the impact of family, financial personal issues on performance. Overall, the BSP appears highly effective for African American

and Hispanic students. CAPS will seek to increase access into math and biology for AI students, which makes up 13% of Oklahoma's population, but is one of the lowest represented URG groups in science. Additionally, the CAPS program will support Mathematics majors, which will also expand the BSP model.

The CAPS project plan entails multiple co-curricular supports other than recruitment, financial need scholarships, and other support services already in place at MACU to build institutional capacity to support economically disadvantaged, first generation and URG students at MACU. The purpose of these activities is to increase CAPS members' self-efficacy, community, and emphasize value in understanding and demonstrating knowledge of their math or science major content. The CAPS co-curricular activities include:

1) Enhance retention through peer-to-peer mentoring and laboratory support with an emphasis on supporting incoming freshmen, and faculty-to-student mentoring. MACU will adapt a peer-to-peer mentoring program for incoming freshmen and transfers. Additionally, faculty mentoring will occur for all CAPS members, including the mentor upperclassman and the mentee incoming freshman and/or transfer. Research partnerships will be developed between the mentor and mentee, supplemental readings posted on D2L with discussion board monitoring, and independent study in a laboratory setting. Further, CAPS members will also be encouraged to tutor students from partner institutions or from their home communities via approved online after-school communications supervised by faculty.

2) **Improve communications across math, biology, and chemistry disciplines through small group journal clubs.** MACU will offer an interdisciplinary journal club for onehour upper division credit. Incoming freshmen and transfer CAPS members will attend at least one presentation by their upper division mentor(s). MACU will also videotape each CAPS scholar's presentation and make them available to the scholar's alma-mater high school science class by posting on Desire2Learn (D2L) and granting the high school access to MACU's network. This will serve to increase self-efficacy and also serve as a recruitment tool. Journals will be used by CAPS members to consider their crosscutting activities, presentations, and tutoring for partner institutions, and other URG organizations to further enhance, MACU's social media and presentations to high school classes.

3) Encourage students to become independent critical thinkers through both formal and informal small group assignments and research through Learning Communities. "Learning Communities... have been found to provide benefits for students and faculty including "higher academic achievement, better retention rates, diminished faculty isolation, and increased curricular integration" (Lenning & Ebbers, 1999). The Learning Community development will be a new organization on the MACU campus called the CAPS Society. It will serve to increase self-efficacy, confidence, and communications across disciplines. Society members will develop and maintain social media accounts with the supervision of a faculty mentor. They will also plan and attend events outside of normal campus activities such as local, state, and regional conferences with either the PI, CO-PI or other supporting staff. Furthermore, CAPS society members will be encouraged to attend other NSF funded research projects pertaining to research at other higher education institutions. CAPS Society will also serve to increase a sense of belonging to members and include non-academic activities.

4) Guide students through the application process of applying for professional graduate schools. Beginning the initial CAPS year, all incoming students will meet with a mentor to begin building their curriculum vitae (CV). During their Junior year, students will be assessed for graduate school interest. If the student indicates the desire to attend graduate school, the faculty mentor will assist the student with information on how to apply for graduate school. The mentor will also assist the mentee in one-on-one sessions for writing letters and emails to prospective graduate schools. Graduate Record Examination dates and locations will also be disseminated to upperclassman.

MACU's Mathematics and Biology program places an emphasis on scholarly work. In order to evaluate this goal, all students in the CAPS program will work collaboratively with faculty and fellow students on a number of key projects as described in Section d. These crosscutting projects are designed to develop the core competencies represented by the rigor of an undergraduate university program in mathematics and biology. All students participating in CAPS will be assessed based on grade point averages (GPA's), test scores, journal club presentations, and both formative and summative surveys.

## c. Significance of Project and Rationale

Regionally, Oklahoma City has a large population of URG's who can contribute to the high-need STEM fields. MACU is a small private university located in Oklahoma City, Oklahoma. MACU reflects a diverse population that can significantly contribute to research that will lead to an increase in URG's choosing a math or science major and persisting to degree. Furthermore, MACU's School of Mathematics and Science faculty committed to the CAPS program represents the characteristics of a URG population with two female faculty each holding a Ph.D., and an American Indian Ph.D. faculty member. MACU's undergraduate student population by gender consists of 59 percent women and 41 percent men. Its population of 2,558 students includes nearly 23% African Americans, 6% Latino and 4% American Indian among other races (Figure 1). CAPS would enable MACU to increase recruitment of URG students in these fields by providing resources to recruit and educate more students from diverse populations, as well as an environment led my an American Indian PI and a female Co-PI. With an average student to faculty of ratio of 12:1, MACU dedicates substantial co-curricular support to URG's with limited resources.

Demand for individuals with science, technology, engineering and mathematics (STEM) degrees remains very high in Oklahoma with more than 83,000 jobs in Oklahoma in STEM fields, including Physics, Geoscience, Engineering, Computer Science and Life sciences, which are among the top fields for projected growth between 2016 and 2026 in Oklahoma. Yet, the NSF reports that "The representation of certain groups of people in science and engineering (S&E) education and employment differs from their representation in the U.S. population" (National Science Foundation, 2017). Oklahoma EPSCOR reports that:

"we are starting at a deficit: Women, representing 51 percent of the U.S. population, remain underrepresented in engineering (19 percent), computer sciences (18 percent), physics (19 percent), and math (43 percent) fields, according to the most recent National Science Foundation Committee on Equal Opportunities in Science and Engineering Report. African

Americans, Hispanics and Native Americans, as a group, make up 28 percent of the U.S. population, but hold only 12 percent of science, technology, engineering and math (STEM) jobs according to the [The National Academies' 2011 Expanding Underrepresented Minority Participation Report]."

While the number of scholarships available are limited, the CAPS program will be open to all of MACU's current and projected number of between 50 and 70 mathematics and science majors during the five-year project period. By ranking the benefits of various co-curricular interventions, CAPS will help build new models of what works in improving undergraduate student outcomes, particularly for URGs and economically disadvantaged students.

**Financial Need**: CAPS scholarships will be awarded to incoming high school and transfer community college students who are either recruited nationally to attend MACU, or who attend partner schools including SFPS high schools and OCCC. MACU will also reach out to students already enrolled at MACU's diverse student body who are currently enrolled in a MACU Biology or Mathematics degree program and who meet the Free Application for Financial Assistance (FAFSA) determination of need.

MACU has identified the financial need gap for all its students enrolled in the 2018-2019 academic year in the College of Arts and Sciences (Table 1). The average need gap for MACU's undergraduates is \$6,582, which represents the average amount these students borrow in federal loans to fulfill their financial obligations to the institution. MACU anticipates providing a maximum 60 scholarships for students over the five-year project period depending on financial need.

2018-2019 Domestic Students Average Cost of Attendance \$31,276	# of Students	Nu den fina ov	mber and % with nonstrated ncial need rer \$500 <sup>1</sup>	Nu den fina ov	mber and % with nonstrated ncial need er \$5000	Average Financial Need	Nun % ( F Lo Cov	nber and utilizing ederal oans to ver Cost of endance	Average Amount of Loans <sup>3</sup>
College of Arts & Sciences	50	41	82%	41	82%	\$23,624	33	66%	\$7,243
First Generation	18	18	100%	18	100%	\$25,358	12	67%	\$7,743
Under Represented <sup>2</sup>	30	23	77%	23	77%	\$22,215	22	73%	\$5,571

 Table 1: Financial Aid Need Gap for All Mathematics and Biology Majors at MAC

<sup>1</sup>Average Financial Need = Average Cost of Attendance - Average Estimated Family Contribution. <sup>2</sup>Underrepresented = African American, Hispanic, American Indian, Native Alaskan, Native Pacific Islanders. <sup>3</sup>The average amount of loans includes ONLY those student who took out federal loans. Note: First-generation and Underrepresented are not mutually exclusive categories.

Based on the availability of funds up to 12 scholarships annually, since the average financial need for MACU's students is \$6,582. However, MACU may increase a scholarship award up to \$10,000 for a CAPS scholar based on need. While CAPS will serve all of MACU's Mathematics an Biology majors, scholarships will be limited to academically talented, economically disadvantaged students from MACU's undergraduate body, from traditional recruitment, and from partner schools identified for this project.

Current reporting data for MACU shows that 28 of the 52 Math and Biology majors report as URG's with only one female Math major and four of the total math and biology majors who are AI. CAPS' objectives include increasing the recruitment (see Section f) of Mathematics and Biology majors, first generation college students, and underrepresented students in the biology and math degree programs who meet the CAPS criteria. This aggressive strategy will build capacity for MACU to retain more math and biology majors through graduation to meet regional demand in these fields.

Objectives	Expected Outcome
Recruit CAPS scholarship recipients as math or	All Biology and Math majors in CAPS, with
biology major over project period.	augmented services for scholarship students.
Increase number of academically talented,	Increase number of economically disadvantaged and
economically disadvantaged, and URG (not	URG students as undergraduate math and biology
mutually exclusive) students as math and	majors by recruiting from diverse student high need
biology majors through co-curricular strategies.	schools and MACU's students.
Increase gateway course retention from Biology	Retention increased. A greater percentage of all
I and II, and Calculus I, II and III and	CAPS participants will complete gateway courses
Chemistry I and II.	and persist to degree.
Use BSP model to support all CAPS	Participants will see improved academic
participants (all math and biology majors.	performance, increased retention, and increased
	self-efficacy.
New co-curriculars implemented including:	Predictors of success evaluated and ranked based on
financial/scholarships, mentoring, academic,	regression analysis contributing to retention
social, journal clubs, CAPS Society and study	literature. Changes based on student needs and
groups.	feedback.
Use Enhanced BSP model, and consider Tinto's	Participants will see improved self-efficacy,
research to support CAPS scholarship	academic performance, retention, and persistence to
recipients.	degree.

# d. Activities on Which the Current Project Builds

As previously described, the CAPS program builds on the BSP model and considers Tinto in developing an environment that supports all CAPS members, but meets the needs of the economically disadvantaged URG students who will benefit from this program. CAPS will build on MACU's existing biology and mathematics degree program requirements by creating a new residential CAPS Society Learning Community expressly for Math and Biology majors at MACU. The Learning Community will be enhanced for CAPS participants through peer and faculty support. The Learning Community is designed to promote networking, sharing ideas, peer studying, and social support system building, and should foster students' success by providing additional opportunities for mathematics and biology students to interact outside of class. Learning Centers have been shown to heighten participants' sense of shared responsibility (Heritage, 2013). Furthermore, the student-tostudent learning style that permeates learning communities has been shown to contribute to the success of minority students (Estrada, M., 2016). The CAPS Society builds on the approach of the MIT Chapter of the American Indian Science and Engineering Society [AISES], which is a student-run group aimed at promoting Native American culture and community and that promotes STEM related education to tribal communities. The model includes creating a social framework that allows students to benefit from one another, share culture, and incorporates community events such as Weekly Lounge Hours, Monthly Dinner Meetings and Movie Nights.

All mathematics and biology majors at MACU will continue to use current Student Support Services, but CAPS members will also have access to all four of the proposed co-curricular activities and will be encouraged by the PIs and faculty to participate in all CAPS activities. However, CAPS will enhance this experience for scholarship recipients by requiring contributions to all four co-curricular programs to maintain their scholarships including: (1) participation in all peer and faculty mentoring opportunities, including laboratory support; (2) joining a small group journal club and study group, which also includes Independent Lab Access), a study group activity that occurs outside normal class time. All CAPS students will be assigned a peer laboratory partner for independent review of their research; (3) joining the CAPS Society Learning Community to encourage self-efficacy, confidence, and communications across disciplines; and, (4) obtaining support from math and science faculty to understand the process of applying for professional graduate school.

## e. S-STEM Project Management Plan

Table 4 provides an overview of the MACU project team (Key Personnel). The Principal Investigators (PIs), Dr. Harold Kihega, Biology Faculty and Dr. Carol Fowlkes, Mathematics faculty are co-chairs of the School of Mathematics and Science. Dr. Deshani Fernando, Chemistry faculty will provide additional support in this role. Throughout the academic year, the PIs and the CAPS coordinator will be responsible for all aspects of research including: oversee recruitment strategy; oversee research protocols; obtain student records; prepare research data and analysis; oversee student support services; oversee budget reports; oversee assessment of grant outcomes; review project evaluation; make program adjustments based on student surveys; prepare a peer reviewed study; and, disseminate final evaluation report. The AI and female Co-PI's will also serve as role models and mentors, interacting with students in-person at CAPS Society events and through meetings with scholarship students. These personal connections separate MACU from other institutions' programs. Annual quantitative and qualitative analyses will be prepared by the Co-PI's during the summer months, as demonstrated in the budget. The above tasks will be performed during the academic year as part of the Co-PI's faculty duties. Morgan Thompson, M.Ed. will serve as Assessment Specialist and an Independent Evaluator will be hired to review and evaluate comprehensive annual program analyses and evaluation reports. A new CAPS Coordinator who will be hired part-time for this project, and which will be sustained as a laboratory assistant following the project period, will be tasked with the following: recruiting and accepting the qualified students (biology and mathematics) into CAPS; oversee student schedules and manage relationships with SSC services; work with the Office of Financial Aid to ensure financial eligibility; determine amount of scholarship award based on need; oversee academic advising for students; write surveys for faculty and student participants, with PI and Co-PI oversight; analyze and present data for monthly team meetings with PI, Co-PI's and Project Evaluator; organize enrichment activities with PI's; support implementation of the internship program and its placement activities; establish protocols to assess the program's impact; and, prepare reports to meet program requirements.

 TABLE 4: Project Management Plan

		Name	Job Title	Reports To	Duties/Requirements
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Harold Kihega, PhD, Principal President, Vice- Duties: Administer the grant and	d
Professor of Biology, Investigator President of prepare annual reports, budget a	ınd
Co-Chair School of Academic Affairs outcome charts	
Mathematics and and Chief Financial <b>Requirements:</b> PhD	
Science Officer	
Carol Fowlkes, PhD, Co-Principal President, Vice- Duties: Administer the grant and	d
Professor of Investigator President of prepare annual reports, budget a	ind
Mathematics, Co- Academic Affairs outcome charts	
Chair School of and Chief Financial <b>Requirements:</b> PhD	
Math and Science Officer	
Dr. Deshani Faculty and PI Principal Duties: Serve as faculty and a	s a
Fernando, PhD, Support Investigators mentor to CAPS members.	
Professor of Support CAPS Coordinator r	ole.
Chemistry	
CAPS Coordinator, CAPS Coordinator Principal <b>Duties</b> : Oversee student	
Investigators recruitment, faculty coordinatio	n
and support service navigation.	
<b>Requirements</b> : Masters	
Morgan Thompson, Assessment Principal <b>Duties</b> : Oversee student SSC,	
M.Ed, Dean of strategies and Investigators scheduling, faculty relations, and	d
Student Success & assessment reports support services. Prepares	
Accommodations assessment strategies, statistical	
Director analyses and reports.	
<b>Requirements:</b> Masters	
Social Scientist Independent Principal <b>Duties:</b> Prepare independent	
Independent Evaluation Investigators and evaluation of program assessme	ent.
Evaluator Co-Principal of Submit data to PIs	
Investigators Requirements: PhD	
Mici Sartin MS Budget Director Principal Duties: Prenare and manage ve	arly
Chief Financial Investigators budget and conduct audit to ass	ure
Officer Compliance with the NSF and	110
MACU Submit data to PIs	
Requirements. Masters	
I Mis Ashley Gotcher I LEEMIS Principal I Duffes' Identity eligible candid	ates
Ms. Ashley Gotcher IEEMS Principal Duties: Identify eligible candid Director of Admissions Investigators and refer to PI/Co-PI	ates

At the end of each semester, the PIs, Coordinator, Assessment Specialist, and Independent evaluator will meet to evaluate the effectiveness of each CAPS activity based on review of student files and survey data. The Evaluator will be responsible for documenting the evaluations and action items. The PIs will assign action items to the relevant personnel and monitor the completion of action items to ensure the program undergoes continual improvements. The progression of these improvements through the program model will be measured based on student satisfaction surveys.

Activities, l	Responsible	Party (Task Owner	r), Timeline are below:
	Year One -	Schedule of CAPS	Activities

Timeline	Task	Task Owner
July 2019	CAPS program launch. Program materials to market	PI, Co-PI Admissions
	CAPS to regional high schools developed. CAPS	and Student Services

	Scholarship candidates from current MACU Math and Biology Majors identified for fall semester. OCCC transfer students recruited to scholarship program.	
July/August 2019	Dissemination of materials to regional high school guidance counselors by Admissions. Notification to current MACU and OCCC Scholarship candidates of award.	PI, Co-PI, TC, Admissions, IT and Student Services
August- September 2019	Scholarship material dissemination and recruitment by Admissions at targeted high schools. Presentation by PI at partner schools.	PI, Co-PI, TC, Admissions, IT and SSC
August 2019	Students accepted into CAPS for fall 2019 receive a guide on requirements for the CAPS program and attend orientation during first week of classes. CAPS begins.	PI, Co-PI, TC
Spring 2020	Marketing for Year 2 scholars begins. Adjustments made.	PI, Co-PI
Fall 2020	First cohort begins Year 2 of CAPS. Second cohort attends orientation and begins Year 1 of CAPS.	Pi,Co-PI
	Activities, Responsible Party (Task Owner), Timeline	

Years Two-Five– Schedule of CAPS Activities

Timeline	Task	Task Owner
Spring 2021	Third cohort recruited for fall semester. Adjustments	Pi, Co-PI, Admissions
	made.	
August 2021	Third accepted cohort attends orientation and begins	Pi, Co-PI, TC
	CAPS. Cohorts 1 and 2 continue academic years.	Admissions
Spring 2022	Fourth and final cohort recruited. Adjustments made.	PI, Co-PI
Fall 2022 –	All CAPS scholarship recipients continue program	
Spring 2023		
Fall 2023-	Final year of CAPS begins. Program winds down. Project	Pi,Co-PI
Spring 2024	teams seeks private scholarships to sustain program.	
Annual	Annual assessments for each program year prepared by PI	PI, Co-PI, internal
assessments	and Co-PI and reviewed by internal reviewer. Data sent to	assessment
Spring 2019-	independent reviewer for completion by spring 2024.	
Spring 2024		
Comprehensive	Reviews by Pi, Co-PI, internal and independent evaluator	PI, Co-PI, internal and
assessment and		independent assessment
evaluation		

## f. Student Selection Process and Criteria

MACU's plan is to recruit academically talented students to CAPS through MACU's traditional recruitment process, from among current, academically talented Math and Biology majors at MACU, and from three economically and racially diverse schools including Santa Fe Public Charter Schools, Oklahoma City Public Schools, and Oklahoma City Community College. Students who meet minimum program requirements will be provided literature on the CAPS program by their school counselors. They will be invited to participate in CAPS through regular admission or under a scholarship. CAPS will employ a number of recruiting strategies. First, the CAPS PI and Co-PI will strengthen MACU's relationships with identified schools science and math faculty, and the Director of Admissions will work with counselors. Second, CAPS scholarships will also be awarded to incoming high school students and transfer students based on Free Application for Financial Assistance (FAFSA) determination of need and who have GPA's of 3.0 or greater. Third, CAPS scholarships will also be granted to current women and

underrepresented minorities who are MACU students in biology or mathematics degree programs with a GPA of 3.0 or greater and who meet the FAFSA determination of need.

The Director of Admissions will recommend CAPS participants and scholarship recipients for the academic year beginning in the Summer of 2019. In order to be eligible to participate in CAPS, students must meet the following criteria: 1) meet the requirements for acceptance to MACU, 2) have a GPA of 3.0 or higher, 3) qualify for financial aid as determined by FAFSA, and 4) demonstrate strong motivation and community leadership through an essay, 5) have a strong letter of recommendation from a high school science or math instructor. All students who meet these requirements will be invited to interview with a selected committee consisting of the PI, Co-PI, a faculty member outside of the School of Math and Science and a current MACU student prior to participation in CAPS.

The PIs and Co-PI will examine and evaluate all properly completed applications and determine which students will be invited to join the incoming class. Invited participants will be asked to sign a statement of understanding designed to provide the applicants with understanding that the grant is contingent on the students' completion of the activities designed for the CAPS students and contingent of their continuous enrollment in MACU's Mathematics or Biology programs. Overall the criteria used to determine participation in the CAPS, include: 1) student academic record, 2) student essay, 3) student participation commitment; 4) willingness to participate in all of the extra activities designed for CAPS participants, 5) student GPA, 6) student continuous enrollment in the MACU Mathematics and/or Biology program, 7) student interviews with their counselor. The application process and CAPS information will be added to the MACU list of financial aid opportunities for potential and existing students seeking scholarship information, including on MACU's website. This information will be forwarded to all of the local high schools in the metropolitan area regarding the CAPS. Additionally, scholarship information will be forwarded to local and national associations for biology, math and science. (Do we give partner schools priority?) Is that a no-no?

g. S-STEM Student Support Services and Programs – MACU currently offers the following support services to all of MACU's students, and will enhance its capacity through CAPS funds as follows: Student Success Center (SSC) provides Supplemental Learning, Academic and Counseling Support and Assistance, Self-Awareness and Accountability support, and Development services. SSC offers Career Development, a Writing Center, Academic Support & Tutoring, Writing Center support, Academic Support & Tutoring and Career Advising Appointments. CAPS will augment these services by creating a math and science based central support community system to address academic and college-life issues to ensure students are performing well academically and adjusting to the demands of college life. A peer-mentoring program will be established to assure success for the candidates and provide sustainability for the program. All incoming freshmen will be assigned an upperclassman student mentor. Upperclassmen in CAPS will be encouraged to serve as independent peer-to-peer laboratory partners. They must demonstrate a willingness to participate by committing to a minimum of two hours per week to peer mentoring and tutoring and have demonstrate continuous academic success in Biology and/or Mathematics courses.

Strategies to Achieve Retention: SSC was created to help students overcome the challenges of high school to college transitions. Certain challenges make it difficult for students to complete college degrees, particularly high educational costs, inadequate advising and student support services, and lack of incentives to assist students complete their degree plans (Lumina Foundation, 2001). Low income, first-generation students are more than 40% less likely to complete a four year degree after six years than more advantaged peers (Engle & Tinto, 2008). CAPS retention strategies that build on current educational activities and community involvement for Freshman include: Pre-program self-assessment; Attend CAPS Society Learning Communities; Assigned independent peer-to-peer laboratory partner; Participate in Co-Curricular Research Project(s); Begin developing a CV. Sophomores must: Attend supervised in-person CAPS Learning Community Journal Club session by their mentor; Critical analysis of a peer-reviewed article as described in research by Hoskins et al., 2006; and, Participate in Co-Curricular Research Project; Juniors must: attend seminars with MACU Scholars; be assigned as a mentor for incoming freshmen; join a Learning Community; critical analyses of two peerreviewed articles with a debriefing for mentee; contact Professional or Graduate Schools; and, Participate in Co-Curricular Research Project. CAPS Seniors are required to prepare and post a CV at the Student Support Center; become a mentor for Freshman-Juniors; participate in mock interviews; meet with the SSC; lead a journal club session; Participate in Co-Curricular Research Project; complete a post-program self-assessment; and, participate in an exit interview with a CAPS investigator.

**Strategies for Internships, Career and Graduate School Placement**: The MACU Career Readiness Center offers career services to all students. The Dean of the Student Success Center will work in collaboration with the PI's to assist the CAPS students with career planning. These efforts will include: creating Learning Communities; promoting internship opportunities in their field of study for students who have completed five semesters; evaluating student records to ensure they can clearly demonstrate their knowledge and competencies; planning group attendance at local career fairs; and offering mock interviews tailored to their career of choice. If CAPS students are interested in entering a graduate program after completing their degree, SSC staff and math and science faculty will help guide them through the application process.

**Community Service**: All MACU students are currently required to perform a minimum number of twelve hours of community service, and this requirement will continue for the MACU learning community. Mathematics and biology majors may serve as tutors or judges at local high school Science Fairs to complete this service commitment

## h. Quality Educational Programs

MACU offers quality Biology and Mathematics degree programs and has an established set of high quality student services. MACU holds that there are intelligent, hardworking URG's and first generation college students who would thrive in STEM education and careers with the right combination of quality programs and support services. Over the past five years, MACU has made diversity of its student body a significant priority as demonstrated in Figure 1 with almost 23% African American students, 6 % Latino, and 4% American Indian. Women represent 59% of the student population. Current mathematics and biology major

progressions include: Year 1 and Year 2 – Gateway courses in biology, mathematics and chemistry such as Biology I and II, Calculus I, II and III, Introduction to Statistics, and Chemistry I and II; and Physics I and II; Year 3 students must demonstrate an understanding of materials from Year 1 and Year 2, and third years students in upper division math courses and/or biology courses must show the above competencies are met including final projects and research projects; and, Year 4 students must demonstrate an understanding of upper division math, biology and/or chemistry courses that show competencies met. MACU engages in three distinct processes to ensure the quality of its academic programs. First, each academic program engages in regular assessment of students' performances for the purpose of data-driven quality improvements in curriculum and instruction. Second, MACU assesses each unit or department's strategic plan to ensure each program is setting and achieving aspirations for quality. Third, under MACU's Program Review Policy, all academic programs to undergo a review every three years by an external expert in the field. In addition to the three on campus strategies for quality assurance, these goals are also externally expected and evaluated by the Higher Learning Commission, our accrediting agency.

## i. Generation of Knowledge

The MACU team will use the BSP as a guide to develop a similar model to build institutional capacity for increasing the number of URG students who participate as biology or mathematics majors at MACU with to goal of standardizing cross-cutting, co-curricular activities by measuring the effectiveness of these strategies in improving outcomes for students. Mentoring, building community and transitions are key elements of the BSP model (Matsui, 2003). CAPS emphasizes many of the co-curricular strategies used through BSP, with the goal of ranking these strategies in order of their effectiveness in increasing retention, persistence and self-efficacy in these majors, which has been identified as an area of research that needs to be further explored (Gandara et al., 1999). In addition to providing needbased scholarship support, CAPS students have the opportunity to participate in four co-curricular activities including mentoring and tutoring, journal club, Learning Community (CAPS Society), and graduate education support services. Students will benefit from maintaining journals and sharing through learning communities. Through these teaching and learning tools, the project team will assess and evaluate whether increases retention and persistence, and academic success for URG's and particularly AI students.

## j. Assessment and Evaluation:

The co-curricular interventions employed in the CAPS program will be assessed by qualitative and quantitative methods to determine if, and to what degree, the interventions achieve the desired goals of promoting URG students' interest and success as Mathematics and Biology majors. Assessment will use three methods of assessing each intervention, for the triangulation/validity of the findings. Such triangulation methods may also indicate strength or weakness of each intervention, and thus suggest adaptations to future implementation of the program to ensure better, or stronger, outcomes.

To answer the research question quantitatively, a regression analysis will be conducted. The PIs will look at student's perceived contribution that the four co-curricular activities had on their success as a biology major or math major. To measure success the PIs will compute the cumulative grade point average in their gateway courses (i.e. Biology I, Biology II, Chemistry I, Chemistry II, Calculus I, II, III, and Physics I and II) The students will complete a survey, ranking the contribution of that particular co-curricular activity on a Likert scale.

This data on the co-curricular activities will be collected throughout the five years looking at the data and co-curricular activities will be adjusted based on CAPS students perceptions and data-driven decisions. As the CAPS scholars matriculate through the program we will measure self-efficacy by interviewing juniors and seniors to find emerging themes. In addition to assessing the four primary co-curricular activities, the PIs will also measure outcomes for recruitment.

**Increase recruitment of URGs through scholarships**: CAPS will assess whether <u>URG students and scholarships intervention</u> was successful in recruiting and retaining a significantly larger population of URGs having financial need. The following assessment methods will be used: (1) *Surveys* will be given to students to determine (a) what percentage of scholarship students would not have considered this educational option without active recruitment by MACU, and (b) what percentage of students would not have been able to consider such an educational opportunity without financial assistance provided by the grant. (2) A *comparative assessment of URGs* enrolled in the Mathematics and Biology programs and successfully graduating over the last 5 years before the grant assistance will be compared to the CAPS scholarship students that start and remain in the program to attain degrees. (3) *MACU student record data analysis* will determine if greater numbers of targeted URG students apply to MACU, are accepted, retained, and graduate from MACU as Mathematical and Biology majors, as well as graduate school acceptance and professional job placement.

Improve communications across math, biology, and chemistry disciplines through small group journal clubs and the CAPS Society Learning Community: CAPS scholarship students will be required to be involved with peer-mentoring and community service such as tutoring students in their tribes, tribal community groups, or the participating schools in math and science to increase math or science knowledge within the community, while non-scholarship students are encouraged to participate in these activities. The intervention of MACU math and science majors participating in a cocurricular activity of mentoring/tutoring regional K-12 school systems' students has the following objectives: increasing CAPS's participants self-efficacy in understanding and demonstrating knowledge of their math or science major; promoting academic understanding and academic success of their mentored students; of enhancing mentored students' interest in further math and science education and careers. To determine if and how these interventions met the intervention's objectives, the following assessments will be employed: (1) comparative analysis will collect data from both cohorts of student time in these activities, their course and test grades, retention and graduation. (2) A survey given to all CAPS society members to determine their perceptions concerning the benefit of such experiences. Questions may include the following: Do you believe the peer-to peer mentoring was beneficial to you, and why? Did you believe these experiences helped contribute to your knowledge of the discipline and why? Do you believe that your community service contributed to additional interest and knowledge of your discipline within your community, and why? Did this service promote your self-efficacy as a Mathematic or Biology scholar and leader? (3) *Journal entries and records of student input during group discussions* will be used to collect data about the interventions' value to students. An additional assessment tool of (4) *quantitative analysis* will be administered by researching the number of pre-intervention (from the last 5 years) URG students admitted to Mathematical or Biology programs, finding their retention and graduation percentages, versus the same areas of the student population receiving the interventions of the CAPS Program.

CAPS scholarship recipients will receive enhanced services and interventions, including: (1) leadership roles in the journal club and the annual Research Day as upperclassmen; and (2) faculty-led field trips. Each of these areas will be assessed for program outcomes listed above by collecting supportive data from (1) *students' journal entries, and (2) pre- and post-semester interviews*. Further data will be collected by (3) *reviewing student log-in of time in computer lab and simulation center, participation in Learning Communities, and attendance of CAPS* activities. The CAPS scholar students and the non-scholar cohort will be assessed on grade point averages (GPAs), test scores, computer simulation program scores, and both formative and summative surveys.

The small group journal club's intervention has the objective of improving communications across math and science disciplines by increased ability to access, analyze, and report scientific research. Students will be *assessed by using students' course grades, retention rates, and increased scientific discourse and project sophistication*. Also, to determine if journal clubs have been effective in promoting students' increased skill in scientific discourse, *rubrics* will be utilized to assess quality of assignment and project grades. A final assessment will be a *journal club writing assignment*, which will have the students reflect and write about: if, how and why they believed the journal club met its objectives; was, or was not, of value; demonstrated improved personal communication skills; and, finally, also increased confidence and demonstrated ability to write using the discourse of a mathematician or biologist.

Enhance retention through peer-to-peer mentoring and laboratory support, facultyto-student mentoring. The intervention of increasing peer-to-peer and faculty-to-student mentoring intervention (which includes the mandatory online chat sessions with faculty during freshman and sophomore years, and CAPS scholars attending faculty-led field trips annually), has the objectives of promoting students' sense of community, confidence, selfefficacy, and retention. Assessment will be conducted by triangulation of data from qualitative surveys, journals, pre- and post-course interviews. The data collected will be used in quantitative comparative analysis between the CAPS scholars required to participate and the non-scholar groups with voluntary participation.

The regional conference intervention\_will take students, at least once annually, to regional conferences. To determine how effective attendance to regional conferences was in development of students' confidence, self-efficacy, knowledge and discipline understanding, the following assessment tools will be used: (1) *journal entries*, (2) *interviews*, and (3) *a ranking survey* will also question whether, how and to what degree

students believe regional conference attendance was effective. This data will be turned into percentages that quantify responses as of "no impact, and why; little influence and why; some influence and why; great influence, and why."

The Co-curricular Research Project is another intervention. Guided by PIs and faculty, the research project will allow CAPS students to demonstrate their semester-gained discipline knowledge. All CAPS students will have the use of software technology, such as MD Excel and MATH Lab, and other MACU instruments and materials to support the research. All CAPS Mathematical and Biology majors are required to write a research article, disseminate their approved work on the MACU departmental website, and to participate in MACU's Research Day to present their research. CAPS scholars will also receive leadership roles in the annual Research Day as upperclassmen. Assessment of the intervention's impact and success will be *analysis of cumulative data* collected by comparing the cohort group data, *surveys*, and *rubrics* to evaluate quality of students' research, final dissemination and presentation of research.

**Guide students through the application process of applying for professional graduate schools.** The final intervention of this proposal will be to guiding CAPS students through the application process of applying for professional schools, or for job searches. This support service intervention will be *assessed by collecting: (1) hours of students' support;* (2) the number of institutions or job positions students applied for; (3) institutional followup interest; and (4) and the percentage of students that received acceptance and placement.

MACU believes that these measurements will provide information valuable to the continuous development and improvement of the CAPS program.

# K. Dissemination

The PIs will both benefit from the publication of this research, and will collaborate with the Director of Communications to plan a strategy for sharing the project and accomplishments with the campus and the local, state and national STEM community. CAPS students will also have the opportunity to share the results of their research at the annual campus research day. Results will be shared with other universities through a CAPS program link on MACU's website. The MACU site link will serve as an e-medium for sharing best practices and lessons learned. Articles, presentations, and resources will be posted as well. Finally, some pages within the CAPS website will be dedicated to the CAPS students and participants to share their student research and testimonials. Dr. Kihega and Dr. Fowlkes also intend to submit a review of the program to peer reviewed publications.

#### **Executive Summary**

Through this College-Level Education and Access for Rural Schools (CLEARS) project, Mid-America Christian University (MACU) in Oklahoma City, Oklahoma intends to improve teaching, learning, and access to high-quality college-level courses to nearly 500 students from four high schools in rural Oklahoma annually who would not otherwise have access to these advanced classes. CLEARS will offer underserved students and teachers at rural public high schools in Stilwell, Alex, Binger-Oney, and Buffalo regularly scheduled course offerings in Science, Technology, Engineering, and Mathematics (STEM) and other fields. STEM courses will include General Biology and Lab work, Environmental Science and Lab work, College Math, College Algebra, and Calculus. Since STEM is interdisciplinary, it is imperative to also offer supporting coursework. Research shows that interdisciplinary relationships between different curricula, e.g., English, Psychology, and History, provide meaningful learning opportunities in STEM for students in a K-12 setting (NASEM, 2018). While STEM content is the focus, the project will also offer students other college-level courses such as Psychology, History, Public Speaking, and English Composition. NASEM (2018) emphasizes the need for additional support outside of the classroom for learning STEM content such as tutors, peers, counselors, college financial advisement, and information technology. Therefore, regularly scheduled "Ask Clubs" between the CLEARS high school students and teachers and MACU faculty, students, and staff will complement all courses. Clubs will include: Ask Faculty, Ask a Tutor, Ask a Librarian, Ask a Financial Aid Advisor, and Ask an Admissions Counselor. All courses and clubs will be offered synchronously throughout the academic year.

CLEARS will deliver subject matter content for teachers and students in grades 11-12 in four remote, rural school districts via synchronous distance learning. CLEARS is an expansion of a prior successful MACU Distance Learning and Telemedicine (DLT) grant project that is currently being implemented called ATOMS (Access to Online Math and Science). ATOMS serves three elementary schools in rural Oklahoma, including Stilwell and Alex school districts, which have also requested services under CLEARS. ATOMS was initiated based on research that indicates initial interest and persistence in STEM education are lost in elementary school, leading to fewer students — particularly underrepresented minorities — pursuing higher education and careers in these fields. CLEARS seeks to expand access to STEM content beyond elementary education to high schools, as well as other courses and offerings in rural locations where access to college-level courses is limited. CLEARS provides students with the academic skills they will need to succeed in college.

The delivery method will include four types of live, synchronous interactions through distance learning: 1) between MACU faculty and school system teachers, 2) between MACU faculty and staff and CLEARS project high school students, 3) between MACU juniors and seniors who are proficient in the respective content (3.0 GPA or above), and CLEARS school system students and teachers, 4) between CLEARS teachers at all four of the networked high school sites. MACU will serve as a Hub for this project, and the four high schools will be End-Users of this service.

The four school systems that will be served by CLEARS are all located in Oklahoma and contained within the following rural independent school districts (ISDs): Stilwell Public Schools in Stilwell, Alex Public Schools in Alex, Buffalo Public Schools in Buffalo, and Binger-Oney Public Schools in Binger, Oklahoma. All four of the End-User sites are outside of a metropolitan statistical area (MSA), limiting their students' access to higher education. The City of Stilwell, the county seat of Adair County, Oklahoma, is located 80 miles southeast of Tulsa, Oklahoma. The population of Stilwell is 4,012. The Town of Alex is located in Grady County, has a population of 548, and is located 45 miles south-southwest of Oklahoma City. The Town of Buffalo is the county seat of Harper County, has a population of 1,175, and is located approximately 150 miles northwest of Oklahoma City. The Town of Binger is a community of 677 located approximately 60 miles west of Oklahoma City in Caddo County. It is the headquarters of the Caddo Nation of Oklahoma, who settled in the area during the 1870s.



These sites were selected as a result of MACU's interest in building relationships with underserved regional school systems. MACU's faculty recognize these remote, agricultural, and frontier communities have limited access to college-level curriculum. In addition to being highly rural communities, the End-User schools have large populations of underrepresented groups. Stilwell's population is 29.1% White, .3% Black, and 50.2% American Indian with over 16% of the population being two races and the remainder other races. Alex, pronounced locally as "Elik," has a population of 93.2% White, 1.4% African American, 3.4% American Indian and 2% other races. Buffalo's population is 94.3% White, .3% African American, .9%, American Indian, .6% two or more races, and the remainder are other races. Binger's census data indicates that 70.5% of the population is White, 6.6% Latino, 11.5% Black, 7.4% American Indian and the remainder are other races or two or more Races. American Indian students and Hispanic/Latino populations are particularly underrepresented in STEM fields (NSF, 2020). These factors increase the importance of providing synchronous STEM learning support to these underserved minorities and underserved communities.

The CLEARS project will be made available to an estimated 500 juniors and senior students annually, with an emphasis on concurrent enrollment in STEM college-level courses. The project services four public Independent School Districts, which includes potentially 340 students per year in Stilwell, 50 students in Alex, 65 students in Binger-Oney, and 45 students in Buffalo. The project will also serve approximately 20 teachers at these four high schools by providing professional development. In addition to being highly rural communities, the End-User schools have large populations of underrepresented groups (URGs) in STEM, including large Latino populations, American Indian students, and females.

Through video streaming technology, MACU faculty will synchronously interact with high school students and teachers, including underrepresented minorities and students from rural, low-income families to prepare students for college and increase their self-efficacy. Further, MACU college students will increase their self-efficacy by working with MACU faculty to demonstrate STEM labs and other content to their high school peers. Both Hub and End-User students will also develop critical English composition, communication, and library science skills to improve their ability to convey the outcomes of their research and provide a working knowledge of college procedures.

To improve self-efficacy, MACU's students will tutor high school students in their respective fields through the Ask a Tutor club. The curriculum taught in MACU courses will serve as guidance for Ask Clubs and may be used by in-service high schools to improve teaching and learning at each participating location. The project is particularly beneficial to rural students who will learn to communicate about subject content with their peers adequately. CLEARS will enable student interaction at all sites with MACU students and faculty synchronously through video streaming technology to enhance learning and understanding of the content. Video conferencing rooms will be established at the Hub site and remote End-User sites to provide distance learning opportunities to the rural schools. Each End-User will have at least one room dedicated for the CLEARS project. These rooms will allow the sites to broadcast one-to-one, one-to-many, or manyto-many video sessions.

Each of the End-User sites has a combination of new, aging, or no technology in various locations at each site. CLEARS will optimize the use of existing technology and supplement this technology to ensure that each site has technology sufficient to meet the needs of the video conferencing in the required location. Stilwell High School will require video-conferencing technology in four classrooms, Alex, Binger-Oney, and Buffalo will require upgrades in one classroom. Computers with video conferencing capabilities will be provided to seven teachers at remote sites – four in Stilwell, and one each in Buffalo, Binger-Oney, and Alex.

None of the End-User sites currently provide devices or internet connectivity offsite to their juniors and seniors. Participating CLEARS schools will receive portable devices to alleviate this problem. Receiving iPads or Chromebooks allows students to participate in synchronous coursework, and communicate with MACU students and faculty, while also being able to study in the evenings. The iPads and/or Chromebooks will be preloaded with apps to allow students to practice the STEM lessons taught via video conferencing. CLEARS also provides cellular hotspots and data plans to provide connectivity to 20% of the student population for those who live in underserved communities. Each of the CLEARS, remote site classrooms will be provided with SmartBoards with video conferencing abilities and accompanying Zoom licenses. This interactive display allows students and teachers at the remote site to draw and deliver written interaction during synchronous courses to ask questions or reinforce topics being discussed. The technology mentioned above is particularly important during the COVID-19 crisis, which will allow for reduced face-to-face interactions through social distancing.

CLEARS high schools will be served by MACU's Schools of Mathematics, Science, English, Arts and Sciences, as well as the University Library. To this end, video conferencing computers and equipment will be added or updated in eighteen classrooms at the Hub site, as well as in one teaching computer lab and one conference room used for tutoring. Twenty-one computers with video conferencing capability will be provided for faculty and the Librarian at the Hub site. MACU faculty and the Librarian will be available from their offices to interact with all participants throughout the day. Interactions may occur through scheduled appointments or through unscheduled communications. MACU juniors and seniors will have opportunities to develop tutoring plans with MACU faculty and End-User high school teachers. IPads will be provided to students at the Hub site for this purpose. Fortuitously, MACU's students mirror the demographics of the region's populations and include 55% minority students and 51% female students who will serve as peer tutors to the CLEARS students, thereby making peer connections favorable. Zoom licenses will be provided to all Hub site participants.

Other technology will be provided specifically to enhance the synchronous learning experience for the science courses. The Hub site and Stilwell High School will receive 3D printing and virtual reality technology to enhance learning while remote. The remaining End-User sites either currently have 3D printing and virtual reality technology in place or requested not to receive this technology. Also, video conferencing equipment and a boom dissecting microscope will be added to the science lab at the Hub site, which will allow for live lab demonstrations. Licenses for systems such as Knowmia, D2L, and TurnItIn will be purchased to enhance the courses with services such as closed captioning for the hearing impaired.

The Hub site will be adding a Technology Specialist position that will support remote learning and handle all classroom video conferencing technical support needs at both the Hub and remote locations. The position will provide training to End-User site teachers using classroom technology for STEM fields and will also address any faculty, teacher, and CLEARS student support needs. The Technology Specialist will handle all warranties and maintenance of equipment to ensure it functions as planned for three years. The Hub site will fund fifty percent of this position.

#### **Publicly Releasable Project Description**

1. Title of Project: College-Level Education and Access for Rural Schools (CLEARS)

**2. Description of the proposed end-user site(s):** Mid-America Christian University (MACU) will serve as the pure Hub for the CLEARS project and deliver synchronous STEM and other college-level content for students and teachers through distance learning technology at four high school End-User sites in the remote, rural school districts of Stilwell, Alex, Binger-Oney and Buffalo, Oklahoma.

## **3.** A brief description of the project:

Through this USDA Rural Utility Service project titled College-Level Education and Access for Rural Schools (CLEARS) project, Mid-America Christian University (MACU) in Oklahoma City, Oklahoma intends to improve teaching, learning, and access to high-quality college-level courses for four high schools in rural Oklahoma that would not otherwise have access to these advanced classes. CLEARS will offer Math, Science, English and other subject content to students and teachers at rural public high schools in Stilwell, Alex, Binger-Oney and Buffalo through regularly scheduled course offerings in Science, Technology, Engineering and Mathematics (STEM) fields including General Biology and Lab work, Environmental Science and Lab work, College Math, College Algebra, and Calculus. The project will also offer these students other college-level classes, including Introduction to Psychology, Fundamentals of Public Speaking, English Composition, and American History. Regularly scheduled live forums called "Ask Clubs" that promote academic discussion between high school students, their teachers, and MACU's Faculty will complement these courses. Clubs include Ask Faculty, Ask a Tutor, Ask a Librarian, Ask a Financial Aid Advisor, and Ask an Admissions Counselor. All courses will be offered synchronously throughout the academic year.

CLEARS will deliver subject matter content for teachers and students in grades 11-12 in four remote, rural school districts via synchronous distance learning. CLEARS is an expansion of a prior successful MACU Distance Learning and Telemedicine (DLT) grant project that is currently being implemented called ATOMS (Access to Online Math and Science). ATOMS serves three elementary schools. Research indicates that initial interest and persistence in STEM education are lost in elementary school, leading to fewer students, and particularly underrepresented minorities, pursuing higher education and careers in these fields. CLEARS seeks to expand access to STEM content beyond elementary education to high schools, as well as other courses and offerings that provide students with the academic skills they will need to succeed in college.

The delivery method will include four types of live, synchronous interactions through distance learning: 1) between MACU faculty and school system teachers, 2) between MACU faculty and staff and CLEARS project high school students, 3) between MACU juniors and seniors who are proficient in the respective content (3.0 GPA or above), and CLEARS school system students and teachers, 4) between CLEARS teachers at all four of the networked high school sites. MACU will serve as a Hub for this project, and the four high schools will be End-Users of this service.

The four Oklahoma school systems that will be served by CLEARS include the Stilwell, Alex, Buffalo, and Binger-Oney. These high schools are contained within the Stilwell Public Schools in Stilwell, Alex Public Schools in Alex, Buffalo Public Schools in Buffalo, Oklahoma, and Binger-Oney Public Schools in Binger, Oklahoma. Stilwell is a city and the county seat of Adair County, Oklahoma, located 80 miles southwest of Tulsa, Oklahoma. The population of Stilwell is 4,012. The Town of Buffalo is a town and the county seat of Harper County, Oklahoma, and has a population of 1,175. Alex Public Schools is located in the Town of Alex, pronounced locally as "Elik," which is a town in Grady County, Oklahoma. The population of Alex is 548. Alex is located 45 miles south-southwest of Oklahoma City and 10 miles south of Chickasha, Oklahoma, with a population of 16,276. The population density is 82 people per square mile. Buffalo is located approximately 150 miles northwest of Oklahoma City and is outside the metropolitan statistical area. The Town of Binger is a community of 677 and is located approximately 60 miles west of Oklahoma City and about 30 miles outside of the Metropolitan Statistical Area (MSA) for Oklahoma City. Binger is in Caddo County, Oklahoma. Binger is the headquarters of the Caddo Nation of Oklahoma, who were settled in the area during the 1870s. These are rural, agricultural communities outside of regional metropolitan statistical areas and have limited access to higher education in the community.

These sites were selected as a result of MACU's interest in improving STEM education among pre-college students in Oklahoma, building relationships with regional school systems, and recognition by MACU's faculty that these remote, agricultural and frontier communities have limited access to college-level curriculum. In addition to being highly rural communities, the End-User schools have large populations of underrepresented groups, including large American Indian and Hispanic/Latino populations who are particularly underrepresented in STEM fields (NSF, 2020). These factors increase the importance of providing higher education options to these underserved communities. CLEARS emphasizes STEM education services for these rural high schools. Current research shows that racial and ethnic minority student enrollment in advanced STEM courses in high school continues to lag behind non-minority enrollment (Garland & Rapaport, 2018) and that taking advanced high school math and science courses is a significant predictor of college success (Klopfenstein & Thomas, 2009).

CLEARS increases access to higher education with an emphasis on STEM teaching and learning. Increased access will be accomplished through MACU's faculty interactions with high school teachers in remote, rural school systems, and by connecting MACU's diverse student body with high school students, many of whom come from similar backgrounds. These peer-to-peer connections, particularly among women and minorities who are underrepresented in the STEM fields, are critical to improving self-efficacy for both teachers and students. According to Margolis (2007), student self-efficacy is a strong determinant for student persistence, motivation, and achievement, as students with low self-efficacy are likely to give up easily or avoid academic tasks. Further, STEM education is critical to the future of the U.S., and increasing the number of women and minorities in STEM is a particular challenge. It is essential to complement the emphasis on STEM by enhancing students' ability to communicate what they have

learned through courses such as English Composition, Psychology, and access to university library services. The overall goals for the project are to support students and teachers at the CLEARS school districts as follows:

- 1. Increase student interest and self-efficacy in math, science, English, and other content;
- 2. Expand access for high school students and teachers to math, science, English and other content, and teacher professional development for grades 11-12 public school students and teachers;
- 3. Increase teacher self-efficacy in subject matter through monthly meetings with MACU faculty to assess the curriculum and to revise as needed.
- 4. Provide access to online teaching by MACU faculty and upperclassmen assigned to work with high school teachers, including synchronous online science, math, English, communication, psychology, and other pertinent curricula;
- 5. Create and maintain a peer-to-peer mentorship program "Ask Clubs" that promotes professional development and self-efficacy or MACU faculty and CLEARS teachers, as well as a mentorship program between MACU upperclassmen and public high school students.

C-1 Rural Area (**Rurality**):

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C-2 Economic Need (SAIPE)

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## **C-3 Special Consideration**

The CLEARS project team is requesting special consideration for this DLT application based on its primary objective of increasing access to Science, Technology, Engineering, and Mathematics (STEM) curriculum in high-need, low-income, rural high schools. The project is aimed at increasing access to higher education for four diverse school districts, with an emphasis on providing STEM content to underrepresented groups. The four school systems in this project have large American Indian populations, which are underrepresented in STEM fields. Stilwell School District, where 45% of the population is American Indian. Alex School District with 3.4% American Indian. Binger-Oney School District with a 13.8% American Indian student population and Buffalo School District with a 1.5% American Indian student population. CLEARS provides synchronous, college-level STEM courses, taught by MACU faculty to the underrepresented groups of students. The project supplements the teaching with "Ask Clubs" for high school students to participate in, such as tutoring from MACU upperclassmen who are proficient in STEM. The project additionally offers high school teachers access to MACU's faculty, who can provide professional development services and coordinate supplemental learning.

## Subjective Criteria C-4 Need for Service and Project Benefits – Up to 30 Points *Need for Service*

Through this College-Level Education and Access for Rural Schools (CLEARS) project, Mid-America Christian University (MACU) in Oklahoma City, Oklahoma intends to improve teaching, learning, and access to high-quality college-level courses for four high schools in rural Oklahoma that would not otherwise have access to these advanced classes. Rural schools tend to offer fewer advanced placement or college preparatory courses, which can alleviate some of the cost of college. When evaluating four-year college enrollment, the National Student Clearinghouse Research Center found that students from low-income, rural schools came out at the very bottom, with only 28% of students enrolling in a four-year institution (Jaeger, Brett Dunstan, Gibson Dixon, 2015). CLEARS will offer students and teachers at Stilwell, Alex, Binger-Oney, and Buffalo public schools regularly scheduled course offerings in Science, Technology, Engineering, and Mathematics (STEM) fields including General Biology and Lab work, Environmental Science and Lab work, College Math, College Algebra, and Calculus. The project will also offer these students other college-level classes, including English Composition, Fundamentals of Public Speaking, and Introduction to Psychology. Courses will be complemented by regularly scheduled "Ask Clubs" between the high school students and teachers and MACU faculty and staff. Clubs will include Ask Faculty, Ask a Tutor, Ask a Librarian, Ask a Financial Aid Advisor, and Ask an Admissions Counselor. Research shows that counselors, college representatives, and college websites increase a student's likelihood of attending a four-year college (Jaeger et al., 2015). All courses and clubs will be offered synchronously throughout the academic year.

CLEARS will deliver subject matter content for teachers and students in grades 11-12 in four remote, rural school districts via synchronous distance learning. CLEARS is an expansion of a prior successful MACU Distance and Learning and Telemedicine (DLT) grant project that is currently being implemented called ATOMS (Access to Online Math and Science). ATOMS serves three elementary schools. Research indicates that initial interest and persistence in STEM education are lost in elementary school, leading to fewer students, and particularly underrepresented minorities, pursuing higher education and careers in these fields. CLEARS seeks to expand access to STEM content beyond elementary education to high schools, as well as other courses and offerings that provide students with the academic skills they will need to succeed in college.

The delivery method will include four types of live, synchronous interactions through distance learning: 1) between MACU faculty and school system teachers, 2) between MACU faculty and staff and CLEARS project high school students, 3) between MACU juniors and seniors who are proficient in the respective content (3.0 GPA or above), and CLEARS school system students and teachers, 4) between CLEARS teachers at all four of the networked high school sites. MACU will serve as a Hub for this project, and the four high schools will be End-Users of this service.

The four Oklahoma school systems that will be served by CLEARS include the Stilwell, Alex, Buffalo, and Binger-Oney. These high schools are contained within the Stilwell Public Schools in Stilwell, Alex Public Schools in Alex, Buffalo Public Schools in Buffalo, Oklahoma, and Binger-Oney Public Schools in Binger, Oklahoma. Stilwell is a city and the county seat of Adair County, Oklahoma, located 80 miles southwest of Tulsa, Oklahoma. The population of Stilwell is 4,012. The Town of Buffalo is a town and the county seat of Harper County, Oklahoma, and has a population of 1,175. Alex Public Schools is located in the Town of Alex, pronounced locally as "Elik," which is a town in Grady County, Oklahoma. The population of Alex is 548. Alex is located 45 miles south-southwest of Oklahoma City and 10 miles south of Chickasha, Oklahoma, with a population of 16,276. The population density is 82 people per square mile. Buffalo is located approximately 150 miles northwest of Oklahoma City and is outside the metropolitan statistical area. The Town of Binger is a community of 677 and is located approximately 60 miles west of Oklahoma City and about 30 miles outside of the Metropolitan Statistical Area (MSA) for Oklahoma City. Binger is in Caddo County, Oklahoma. Binger is the headquarters of the Caddo Nation of Oklahoma, who were settled in the area during the 1870s. These are rural, agricultural communities outside of regional metropolitan statistical areas and have limited access to higher education in the community.

These sites were selected as a result of MACU's interest in building relationships with underserved regional school systems. MACU's faculty recognize these remote, agricultural, and frontier communities have limited access to college-level curriculum. In addition to being highly rural communities, the End-User schools have large populations of underrepresented groups. Stilwell's population is 29.1% White, .3% Black, and 50.2% American Indian with over 16% of the population at two races and the remainder other races. Alex, pronounced locally as "Elik," has a population of 93.2% White, 1.4% African American, 3.4% American Indian and 2% other races. Buffalo's population is 94.3% White, .3% African American, .9%, American Indian, .6% two or more races, and the remainder are other races. Binger's census data indicates that 70.5% of the population is White, 6.6% Latino, 11.5% Black, 7.4% American Indian and the remainder are other races are particularly underrepresented in STEM fields (NSF, 2020). These factors increase the importance of providing synchronous STEM learning support to these underserved minorities and underserved communities.

The CLEARS project will be made available to an estimated 500 junior and senior students annually, with an emphasis on concurrent enrollment in college-level courses. The project services four public Independent School Districts. This includes potentially 340 students per year in Stilwell, 50 students in Alex, 65 students in Binger-Oney, and 45 students in Buffalo. The project will also serve approximately 20 teachers at these five schools by providing professional development. In addition to being highly rural communities, the End-User schools have large populations of underrepresented groups (URGs) in STEM, including large Latino populations, American Indian students, and females. These students will be served by approximately 18 faculty from MACU, as well as the University Librarian. MACU upperclassmen will have opportunities to

collaborate with MACU faculty and End-User high school teachers. MACU's students mirror the demographics of the region's populations and includes 55% minority students and 51% female students who will serve as peer mentors and tutors to the CLEARS students.

Through video streaming technology, MACU faculty will synchronously interact with high school students and teachers, including underrepresented minorities and students from rural, low-income families to prepare students for college and increase their self-efficacy as students able to solve problems independently. Further, MACU juniors and seniors will increase their self-efficacy by working with MACU faculty to demonstrate STEM labs and other content to their high school peers. Both Hub and End-User students will also develop critical English composition, communication, and library science skills to improve their ability to convey the outcomes of their research and provide a working knowledge of college procedures. MACU's students will be able to increase their self-efficacy in their fields by offering tutoring support at network sites that will be coordinated by faculty and teachers. This project is particularly beneficial to Science and Mathematics majors, since teaching this subject matter is known to increase students' understanding of the curriculum's content (Freeman et al., 2014).

Video conferencing rooms will be established at the Hub site and remote End-User sites to provide distance learning opportunities to the rural schools. Each of the End-User sites has a combination of new, aging, or no technology in various locations at each site. CLEARS will optimize the use of existing technology and supplement this technology to ensure that each site has technology sufficient to meet the needs of the video conferencing in the required location. Stilwell High School will require videoconferencing technology in four classrooms, Alex, Binger-Oney, and Buffalo will require upgrades in one classroom. Computers with video conferencing capabilities will be provided to seven teachers at remote sites – four in Stilwell, and one each in Buffalo, Binger, and Alex.

None of the End-User sites currently provide devices or internet connectivity offsite to juniors and seniors. Participating CLEARS schools will receive portable devices to alleviate this problem. Receiving iPads or Chromebooks allows students to participate in synchronous course work, communicate with MACU students and faculty, while also being able to study in the evenings. The iPads and/or Chromebooks will be preloaded with apps to allow students to practice the STEM learning taught via video conferencing. CLEARS also provides cellular hotspots and data plans to provide connectivity to 20% of the student population for those who live in underserved communities. Each of the CLEARS classrooms at the remote site will be provided with SmartBoards with video conferencing abilities. This interactive display allows students and teachers at the remote site to draw and provide written interaction during synchronous courses to ask questions or reinforce topics being discussed. The aforementioned technology is particularly important during the COVID-19 crisis, which will allow for reduced face-to-face interactions through social distancing. CLEARS high schools will be served by MACU's Schools of Mathematics, Science, English, Arts and Sciences, as well as the University Library. To this end, video conferencing computers and equipment will be added or updated in eighteen classrooms at the Hub site, as well as in one teaching computer lab and one conference room used for tutoring. Twenty-one computers with video conferencing capability will be provided for faculty and the Librarian at the Hub site. MACU faculty and the Librarian will be available from their offices to interact with all participants throughout the day. Interactions may occur through scheduled appointments or through unscheduled communications. MACU juniors and seniors will have opportunities to develop tutoring plans with MACU faculty and End-User high school teachers. IPads will be provided to students at the Hub site for this purpose. Fortuitously, MACU's students mirror the demographics of the region's populations and include 55% minority students and 51% female students who will serve as peer tutors to the CLEARS students, thereby making peer connections favorable. Zoom licenses will be provided to all Hub site participants.

Other technology will be provided specifically to enhance the synchronous learning experience for the science courses. The Hub site and Stilwell High School will receive 3D printing and virtual reality technology to enhance learning while remote. The remaining End-User sites either currently have 3D printing and virtual reality technology in place or requested not to receive this technology. Also, video conferencing equipment and a boom dissecting microscope will be added to the science lab at the Hub site, which will allow for live lab demonstrations. Licenses for systems such as Knowmia, D2L, and TurnItIn will be purchased to enhance the courses with services such as closed captioning for the hearing impaired.

The Hub site will be adding a Technology Specialist position that will support remote learning and handle all classroom video conferencing technical support needs at both the Hub and remote locations. The position will provide training to End-User site teachers using classroom technology for STEM fields and will also address any faculty, teacher, and CLEARS student support needs. The Technology Specialist will handle all warranties and maintenance of equipment to ensure it functions as planned for three years. The Hub site will fund fifty percent of this position.

The overall goals for the project are to support students and teachers at the CLEARS school districts as follows:

- 1. Increase student interest and self-efficacy in math, science, English, and other content;
- 2. Expand access for high school students and teachers to math, science, English and other content, and teacher professional development for grades 11-12 public school students and teachers;
- 3. Increase teacher self-efficacy in subject matter through monthly meetings with MACU faculty to assess the curriculum and to revise as needed.
- 4. Provide access to online teaching by MACU faculty and upperclassmen assigned to work with high school teachers, including synchronous online science, math, English, communication, humanities, psychology, and other pertinent curricula;

5. Create and maintain a peer-to-peer mentorship program "Ask Clubs" that promotes professional development and self-efficacy or MACU faculty and CLEARS teachers, as well as a mentorship program between MACU upperclassmen and public high school students.

CLEARS is a project that will provide access to college credit courses for students enrolled in rural Oklahoma school districts. The priority is to provide quality STEM content to rural high school students using synchronous methods. Since STEM is interdisciplinary in nature, it is imperative to also offer supporting course work in non-STEM fields. Research shows that interdisciplinary relationships between different curricula, e.g., English, Psychology, and History, provide meaningful learning opportunities in STEM for students in a K-12 setting (NASEM, 2018). Furthermore, NASEM (2018) emphasizes the need for additional support outside of the classroom for learning STEM content such as tutors, peers, counselors, college financial advisement, and information technology.

The overall goal for CLEARS is to provide concurrent college enrollment and content support for students and teachers at the End-User school districts. The primary purpose of CLEARS is to increase self-efficacy and interest in STEM and other college-level curricula for teachers and students by creating and synchronously providing curriculum that can be used for teaching, tutoring, and mentoring purposes. CLEARS will also increase access to high-quality courses that were selected based on discussions with high school End-User principals and teachers. The project offers five primary direct benefits related to this purpose.

## **Benefits Derived from Services**

1. Increase student self-efficacy in STEM-related topics as measured by student and teacher surveys for up to 500 students and 20 teachers each year in grades 11-12 at four rural high schools in Oklahoma: Through video conferencing, MACU math, science, English and supporting subject majors students will interact with high school students, including underrepresented groups (URGs) and students from low-income families to support the development of self-efficacy from within the student population. Both MACU and rural secondary school students will increase their self-efficacy through live demonstrations of online math and science simulations. High school students will practice and participate in interdisciplinary math and science simulations as assigned by CLEARS teachers and presented by MACU math and science upperclassmen. Faculty and MACU students will work with high school students by creating and supporting an "Ask Club" on each campus that enables high school students and teachers to meet through video conferencing with MACU faculty and students to learn and understand the content of the selected curriculum. CLEARS seeks to increase ethnic minority student enrollment in advanced STEM courses in high school, as minority participation in STEM continues to lag behind non-minority enrollment (Garland & Rapaport, 2018). Evidence shows that taking advanced high school math and science courses is a significant predictor of college success (Klopfenstein & Thomas, 2009). These courses are balanced by English, Psychology, Communications, and Library

resources so students can communicate their subject matter understanding clearly to varying audiences.

- 2. Expand access to college-level courses and curriculum content for grades 11-12 high school students by 25%: Using video conferencing technology, MACU faculty and students will have the opportunity to enroll in college-level courses concurrently and to participate in "Ask Clubs" where students can learn and share college-level subject matter in different settings at the high schools. CLEARS promotes learning for students when assigned by a teacher. MACU faculty will teach courses and participate in Ask Clubs. MACU faculty will provide guidance to MACU upperclassmen to help them work with high school teachers and students to build a community that improves the ability of students to learn and teach subject content. Content delivery may include: video conferencing live courses and live lab demonstrations, curriculum collaboration with teachers, and Ask Clubs where students and faculty collaborate to understand the subject matter in various courses with an emphasis on STEM fields.
- **3.** Increase teacher self-efficacy in teaching for 20 in-service high school teachers annually in STEM and other college-level subjects: The teaching components will benefit high school students and teachers through enhanced teaching methods. Expanded teaching components may include citizen science, live demonstrations, sharing of STEM curriculum with CLEARS teachers, and development of age-appropriate content aligned to the Oklahoma Academic Standards.
- 4. Create and maintain a minimum of 20 peer-to-peer mentorships between MACU students and high school students each semester: At the beginning and end of each semester MACU junior and senior students, mentors and faculty will visit CLEARS high schools to meet with potential students and teachers who will volunteer to receive MACU's teaching and learning services. MACU faculty and students will work with CLEARS students and teachers to create local Ask Clubs at the End-User sites. Ask Club group meeting times will be scheduled online between MACU club members and CLEARS students and teachers. MACU students will meet and discuss available tutoring times with their participating CLEARS teacher and collaborate on desired topics for supporting high school students in the desired subject matter.
- 5. Provide access to mentoring services and online concurrent enrollment for CLEARS high school students, teaching staff, and the communities they serve: MACU faculty will support professional development through video-conferencing technology, including the development of curriculum and lessons in college-level subject matter. In addition, MACU will offer CLEARS teachers continuing education to advance their ability to teach STEM, English, and other supporting subject matter. CLEARS teachers will have the opportunity to visit with MACU Admissions to identify online course opportunities that increase teachers' interest in advancing their expertise.

## Previous distance learning and online learning projects experience:

MACU has substantial distance learning experience and has managed distance learning and online learning technologies since 2000. Professor and author, Dr. Peter Drucker, once observed, "In the Industrial Age, people went to college. In the Information Age, the college must come to people." This observation has framed the university's advancement of distance learning programs principally by two modalities, Interactive Educational Television (IETV) and the Desire to Learn (D2L) platform for online students. MACU was approved by The Higher Learning Commission (HLC) in 2007 to offer all Bachelor's and Master's degree programs 100% online. For the 2018 – 2019 academic year, 81% of the University's student population took their coursework online. The D2L platform provides synchronous and asynchronous instructional and communication tools. More information on this experience is contained in Tab G – Statement of Experience.

MACU is currently procuring and installing technology at three elementary schools in rural Oklahoma in three school districts to increase access to STEM teaching and learning for grades 3-6 students and their teachers. The ongoing DLT project, titled ATOMS (Access To Online Math and Science), provides resources for MACU in Oklahoma City to improve teaching, learning and the self-efficacy of students and teachers in STEM by delivering subject matter content for teachers and students in grades 3-6 at three remote, rural "ATOMS" school districts via synchronous distance learning.

The three school systems served by ATOMS include the Peggs Public School System in Peggs, Oklahoma, the Alex Public School System in Alex, Oklahoma, and the Stilwell Public School System in Stilwell, Oklahoma. Approximately 400 students in grades 3-6 will be served by the grant.

MACU's initial focus on elementary schools is to address the loss in the pipeline of students who enter STEM fields. Often, teachers at the K-6 school level lack the confidence to teach STEM-related content, thus limiting the student's experience and interest in STEM learning (Nadelson, Callahan, Pyke, Hay, Dance & Pfister, 2013). Improving elementary education teaching is essential in order to expose students to formal and informal STEM education. "Since interest in STEM subjects and STEM careers is largely formed by the time children reach the upper elementary and middle school level, it becomes increasingly critical that children's interest in these areas be captured and encouraged during the early to middle elementary grades, long before the point at which they enroll in courses leading to eventual career paths during high school and college" (Daugherty, Cartter, Swagerty, 2014).

If students do not have the self-efficacy from early grades, they are more likely to lose interest in STEM education and are less likely to pursue STEM academics in middle or high school. Therefore, the focus of ATOMS is to improve access to STEM teaching and learning through MACU's faculty interactions with elementary education teachers in remote, rural school systems, and connecting MACU's diverse student body with these elementary school students, many who come from similar backgrounds. These peer-topeer connections, particularly between women and minorities who are underrepresented in the STEM fields, are critical to improving self-efficacy for both teachers and students. According to Margolis (2007), student self-efficacy is a strong determinant for student persistence, motivation, and achievement, students with low self-efficacy, are likely to give up easily or avoid academic tasks. STEM education is critical to the future of the U.S., and increasing the number of women and minorities in STEM is a particular challenge.

# D. MATCHING REQUIREMENTS

As demonstrated in the matching contributions Worksheet below, MACU is fully prepared to provide a 15% cash match for all equipment purchases required to carry out CLEARS. A Letter of Commitment from MACU is also contained in this section.

INSERT MATCH LETTER HERE

Insert Matching Worksheet and

Matching Letter of Commitment here.

## Tab E. Scope of Work

CLEARS is limited in scope and entails providing high schools at four lowincome school districts in rural Oklahoma with access to distance learning technology that promotes teaching and learning for high-need students. Although the program is open to all CLEARS network school district students, the project will emphasize providing additional resources to increase the number of American Indian students, minorities, and women who are prepared to continue STEM learning at an institution of higher learning with a major in a STEM field. Multiple higher education courses will be open to high schools participating in this program. Following is a summary of the measures that will be implemented under CLEARS:

- 1. Offer concurrent higher education courses for all CLEARS school districts (for courses, see the table contained in this section).
- 2. Content support through Ask Clubs.
  - a. Ask Faculty email for time availability (during office hours or by appointment)
  - b. Ask a Tutor check with Student Success Center for hours
  - c. Ask a Librarian by appointment
- 3. Additional support through Ask Clubs.
  - a. Ask a Financial Aid Advisor by appointment
  - b. Ask an Admissions Counselor by appointment
- 4. Teachers from CLEARS districts will receive support for degree and certification options.

The primary activity and priority for this project is to purchase Distance Learning Equipment at partnering schools to meet the goal of increasing access to STEM and other supporting content for grades 11-12. The project will also enable MACU to assist CLEARS teachers with professional development. The project will develop a community of learners between four different sites.



Mid-America Christian University Math Science, English and Supporting Subjects College-Level Course Content

## **Specific Activities, Persons Responsible, and Timeframes**

Upon award of the DLT grant, the CLEARS project team will immediately reach out to technology solutions providers for telepresence technology. Chief Financial Officer, Ms. Mici Sartin, will negotiate final budget details, including finalizing where the matching funds will be invested. Chief Information Officer, Mr. Jody Allen, and Director of Technology Mr. James Taylor will be responsible for meeting with
Information Technology staff from the Stilwell, Alex, Binger and Buffalo School Systems.

The project will be coordinated by Project Director, Dr. Harold Kihega and Co-Project Director Ms. Marsha Kendrick, at MACU. Dr. Deshani Fernando and Dr. Carol Fowlkes will work closely with Dr. Kihega to assess Science and Mathematics needs for the CLEARS high schools and modify curriculum as required to meet the Oklahoma Academic Standards. STEM faculty will begin meeting weekly with English, Library, Financial Aid, and other MACU faculty and staff to coordinate with teachers from the CLEARS school districts to begin organizing the rollout of available courses and Ask Clubs.

MACU's Chief Information Officer will hold an organizational meeting on or shortly after September 1, 2020, by teleconference once notified about the DLT award with MACU faculty, and CLEARS teachers or site coordinators in order to prepare for the installation of technology at Hub sites and End-User sites.

A subsequent in-person meeting will be held by faculty with CLEARS teachers beginning in November 2020, following purchase and installation of the video conferencing technology. The purpose of this meeting is to hold a demonstration of the video conferencing technology to confirm the locations of the technology, including connection points, wireline, and wireless connectivity, and to review the initial rollout strategy for student and faculty services as addressed in this proposal. Courses that will be offered were determined by surveys of the high school End-User sites on the following table:

CLEARS Interest Survey course results				
Alex High School	American History I			
	College Algebra			
	English Composition I			
	English Composition II			
	Elementary Spanish I			
	Elementary Spanish II			
	American Federal Government			
	College Math			
	Environmental Science and Lab			
	Fundamentals of Public Speaking			
	General Biology and Lab			
	Introduction to Psychology			
Binger-Oney High	American History I			
School	College Algebra			
	English Composition I			
	English Composition II			
	American Federal Government			
	Introduction to Psychology			
Buffalo High School	American History I			
	College Algebra			

<b>CLEARS</b> Interest	Survey course results
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	English Composition I		
	College Math		
	Introduction to Psychology		
Stilwell High School	Environmental Science and Lab		
	Fundamentals of Public Speaking		
	General Biology and Lab		
	Introduction to Psychology		

Environmental Science	Alex High School, Stilwell High School
and Lab	
General Biology and Lab	Alex High School, Stilwell High School
College Algebra	Alex High School, Binger-Oney High School, Buffalo
	High School
College Math	Alex High School, Buffalo High School
English Composition I	Alex High School, Binger-Oney High School, Buffalo
	High School
English Composition II	Alex High School, Binger-Oney High School
Introduction to Psychology	Alex High School, Binger-Oney, Buffalo High School,
	Stilwell H.S.
American History I	Alex High School, Binger-Oney High School, Buffalo
	High School
American Federal	Alex High School, Binger-Oney High School
Government	
Fundamentals of Public	Alex High School, Stilwell High School
Speaking	
Elementary Spanish I	Alex High School
Elementary Spanish II	Alex High School

In addition, the site coordinators will be available as follows at each of the CLEARS public school locations:

Location	Contact	Position	
Stilwell High School	Steve Duncan	Director of Technology	
Alex High School	Keith Weldon	Superintendent	
Binger High School	Rex Trent	Superintendent	
Buffalo High School	Dale Spradlin	Superintendent	

MACU's CLEARS project team also coordinated the project with Stilwell School District Superintendent, Geri Gilstrap, in addition to the Director of Technology. These individuals will be responsible for ensuring that the equipment is maintained in a safe location and locked up at the end of each school day. The site coordinators will also be responsible for monthly check-ins with MACU's Chief Information Officer to report on the status of the technology and to troubleshoot any difficulties with the rollout. In addition, the project team will utilize troubleshooting services from the proposed vendor and utilize extended warranties as required.

Remote locations will maintain and protect the equipment and update software as necessary. All equipment purchased for the remote site will be in compliance with adopter technology standards or vendors of the remote sites to ensure they are able to maintain the equipment once received.

All contracts, including ownership documents, will be overseen by MACU's Vice President of Operations, Chief Operations Officer, and Chief Information Officer and provided to MACU's legal services for review. Project implementation will be rolled out as follows:

Timeframe	Activity	Measurements	Responsible team	
			member	
September 1, 2020	Notification of	Team notified. First	Dr. Harold	
	DLT Award.	meeting to discuss	Kihega will	
		technology rollout.	notify project	
			team.	
September 30, 2020	Complete budget	Budget completed	MACU CFO	
		within 30 days, and	completes budget	
		contracts signed.	negotiations. CIO	
		_	and complete	
			legal contracts.	
October 1 –	Finalize	Obtain purchase	CIO	
November 1, 2020	technology list	orders and receipts		
		of delivery. Site		
		work begins using		
		MACU matching		
		funds.		
November 1, 2020 –	Sites finalized,	Connections tested.	CIO and	
December 1, 2020	infrastructure	Initial faculty	CLEARS team.	
	hook-ups	interactions held on		
	confirmed.	weekly basis.		
December 1, 2020	Installation of	Technology	CIO	
	technology	installed at Hub		
		and End User sites.		
November 1, 2020 –	Schedule and	Faculty and	CLEARS project	
January 30, 2021	curriculum	teachers meet in	team led by	
	coordination	person following	Project Director	
	finalized	install of	and Co-Director	
		technology.	Marsh Kendrick	
January 15, 2021	Faculty training	Faculty training for	CIO	
	begins at on-site	the use of		
	session,	technology		
	completed online	completed.		
December 15, 2020	First draw-down	All transactions	MACU Chief	
	funds to obtain	verified through	Financial Officer	
	reimbursement		and Legal	

	for funds if required. Draft ownership contracts	receipts and agency portal.	
January 2021 – July 2021	Ongoing communications between CLEARS network teaching and learning	Improvements made as challenges are identified to improve curriculum and teaching methods.	Project Director Harold Kihega, Math Faculty Carol Fowlkes, and Chemistry Faculty Deshani Fernando
January 2021 and ongoing	Continuing education opportunities for high school students and teachers	Students increase self-efficacy and take concurrent college courses while in high school. Teachers may take continuing education courses.	Project Director Harold Kihega, Math Faculty Carol Fowlkes, and Chemistry Faculty Deshani Fernando

CLEARS will deliver subject content for teachers and students in grades 11-12 in rural Oklahoma via synchronous distance learning. The delivery method will include live interactions with teachers and students at four different high school sites. MACU will serve as a pure Hub for this project, and the four CLEARS schools will serve as End-Users.

MACU's faculty and administration are actively working to develop its partnership with the CLEARS schools due to the institution's expertise in meeting the needs of students like those in the CLEARS high schools. MACU currently offers fully accredited STEM and other related college-levelcourses with an average student to faculty ratio of 12:1. MACU students have a wide variety of interactions and methods to get in contact with MACU faculty throughout the day including, face-to-face interaction, online Desire2Learn (D2L/Brightspace, 2018) format, email, and social media. MACU's upper-division college students will be supervised by a faculty member in the content area specific to the needs of the high schools. Faculty from MACU will also interact with high school teachers in grades 11-12 to assist in content delivery. Subject matter will range from teaching difficult concepts in STEM-related curriculum utilizing a distancelearning format.. CLEARS will support teachers in STEM and other subject-matter curriculum development and self-efficacy.

Ultimately, the goal of CLEARS is to increase the number of students who are interested in pursuing a degree from an institution of higher education, with a variety of academic and career tracks in STEM and other fields. The project team will use distance learning as a tool to help identify academically talented students from rural Oklahoma high schools that are from economically, racially, and gender diverse communities. The public schools are the starting point that can ultimately help fill the regional shortfall in the pipeline of STEM undergraduate majors, which will support U.S. competitiveness in the future, a need defined in the 2012 President's Council of Advisors on Science and Technology Report (PCAST, 2012). MACU will open doors to STEM and other fields.

Professional development will be made available for grade 11-12 teachers to also support their teaching of STEM and other related content in their classroom. MACU faculty will meet synchronously with classroom teachers to evaluate the lessons taught, as well as the resources and lessons that are made available through this project. Finally, faculty and upperclassmen from MACU will work with high school students and teachers to create Ask Clubs at the school sites on various subjects. They will meet through video streaming technology to engage and encourage students to consider higher education options.

#### Tab F. Financial Information and Sustainability

As demonstrated by the included Letter of Commitment from MACU's President, Dr. John Fozard, in Tab D – Matching Requirements, MACU will provide a Cash/In-Kind match of \$108,175.00 towards the CLEARS total project cost of \$829,114.00. The federal share for this project is \$727,939. The availability of the matching funds can be seen in the included documentation. This budget has also been approved by MACU's Board of Directors.

The Hub site will be adding a Technology Specialist position that will support remote learning and handle all classroom video conferencing technical support needs at both the Hub and remote sites. The position will provide training to End-User site teachers using classroom technology for STEM fields and will also address any faculty, teacher, and concurrent student support needs. This position will handle all warranties and maintenance of equipment two to ensure it functions as planned for three years. The Hub site will fund fifty percent of this position.

The success and sustainability of the project will be based on whether multiple interactions are completed on a near-daily basis during each CLEARS school districts' Academic Year. These interactions will be logged on a weekly basis by the site coordinators and by individual MACU, mentors, and faculty.

There are no fees for service for MACU to provide these services to the CLEARS school districts. However, MACU anticipates two potential sources of revenue that result from this project. High school students can begin to receive course credit towards a degree so that they can complete their college degrees on time or early. CLEARS teachers can obtain professional development services to pursue additional certifications, such as an Oklahoma State Teaching Certification in math, biology, or chemistry. Second, MACU views CLEARS as a source of a potential pipeline of students who may ultimately attend the institution. MACU's faculty and student connections are intended to raise awareness of the institution, which may lead to a new growth of MACU's student population. However, CLEARS does not require any high school students or teachers to pursue a degree at MACU. The project may increase awareness of an institution that serves the types of students who attend these high schools. Further, no exclusivity is required by the CLEARS school district to obtain STEM or other subject-matter teaching and learning modules, which may result in school system investments in distance learning.

#### Table G: Statement of Experience

MACU's distance learning aptitude began during its initial partnership with Jones International University in 2000, MACU went on to synchronously broadcast its adult degree completion degree programs to over 21 off-campus locations in Oklahoma utilizing interactive educational television (IETV). MACU had articulation agreements with several colleges such as Western Oklahoma State College, Redlands Community College, Carl Albert State College, Seminole State College, and Oklahoma State University. Dr. Vickie Hinkle, the Director of Teacher Education and the ATOMS project, worked with two of these sites to teach education classes to distance learning students in 2008 and 2009, Articulation agreements were signed with eight technology centers including two military bases, Vance Air Force Base, and Fort Sill. The university also broadcast its classes to two out-of-state locations, Kirtland Air Force Base in Albuquerque, New Mexico, and Otero Junior College in La Junta, in Colorado.

By 2007, MACU was approved by The Higher Learning Commission (HLC) to offer all Bachelor's and Master's degree programs 100% online. In 2018, 81% of the university's student population took their course work online. The D2L platform provides synchronous and asynchronous instructional and communication tools. Therefore, Mid-America Christian University has a long history of providing quality education and instruction to students in remote locations. The Higher Learning Commission's peer review teams have also verified that the University has an experienced and adequate staff to support student help desk requests, as well as addressing any technology interruptions in educational services.

In addition to this long history of providing quality education and instruction to students in remote locations, MACU has already completed initial steps towards the implementation of ATOMS to bring STEM education and other higher education support to high need, rural elementary schools. CLEARS is a natural extension of this experience.

The CLEARS public schools are committed to providing a technology-rich learning environment that enhances, engages, and improves students' educational experiences while preparing them for the world they will experience in the future. These technology resources promote critical thinking, problem-solving, and communication skills, which are required for students to become lifelong learners and productive citizens in a technologically complex, multicultural rich, and globally interdependent environment.

#### Table H: Telecommunications System Plan

MACU's Chief Information Officer has worked with superintendents and I.T. personnel at remote sites to ensure all locations have a telecommunications systems plan in place to ensure a successful project. Over the course of the last month, each project partner has identified the critical infrastructure, links, and broadband capacity required to ensure that educational conferencing technology is operational at all four project sites.

To ensure the proper equipment is being used for video conferencing, MACU personnel attended the Educause Conference in October 2018, a leading conference for educational technology professionals. MACU personnel also attended the Consumer Electronics Showcase in January 2020. Meetings with various technology vendors at the conferences allowed MACU to evaluate new technologies while speaking to vendors about the functionality and effectiveness of synchronous video technologies. The discussion also took place in spring 2019 and 2020 with SKC Communications, a leading video implementation partner in the educational space.

Unlike other systems, this technology service plan (TSP) is not particularly complex because it entails limited connections at remote sites through commercial-off-the-shelf technology. The CIO is highly familiar with Apple, Zoom, and other video technology, which has been used on related projects such as the university's IETV initiative to broadcast classes, serving as a global hub for online video conferencing of Bethel Series classes, and holding online classes for almost 20 years.

Different options were provided by engineers and vendors, and with those discussions, a solution was chosen. To ensure a successful learning video environment, 4K video was determined to be the standard. Video equipment from Logitech was chosen because of its high video quality, ease of use, and ability to pan/tilt/zoom. Jabra 180 degree cameras were also selected. This 180-degree technology allows each student speaking to be seen on the camera to allow for a fully immersed discussion. The computers operating the streaming cameras were chosen from industry leaders Dell and Apple. Multiple vendors were selected for various remote sites to accommodate for their technical support abilities. The telecommunications system is purposely designed to require little ongoing support as not to burden the on-site I.T. staff. Zoom was chosen as the video conferencing software. This software was described as a leader in video conferencing software by Gartner in its 2020 report. Zoom also has a pricing agreement with the OneNet, a state provider of the Internet for K-12 schools. This ensures the renewal pricing for the software is minimal in future years.

The Hub site and Stilwell High School will receive 3D printers and virtual reality devices with computers. Other sites currently have these systems in place or requested not to use this technology. STEM-related software will also be purchased to allow remote students to experience through virtual reality the concepts being discussed or to be able to print 3D models being used in the classroom at the Hub site.

All remote sites will receive wireless hotspots or cellular SIM cards to enable 20% of student devices to operate at their home. This remote connectivity will allow students in rural areas with no Internet access or low-income students to continue their learning and homework into the evening. Each remote school will determine students that are issued hotspots and SIM cards based on need.

MACU will be using the distance learning platform, Brightspace (also referred to s D2L), to engage remote students and serve as a platform for resources to be accessed remotely. Brightspace interfaces with a software application, TurnItIn, to provide plagiarism scanning for all remote students. The final software being purchased for remote learning is Knowmia. This application captures Zoom recording and links them to D2L. This classroom capture software allows all classes to be archived and viewed at a later date. This piece is critical to distance education as it is ADA compliant with closed captioning services and allows students to review missed classes remotely.

The TSP has reviewed broadband speeds, technology requirements, and all infrastructure connections. This coordination was completed between MACU's CIO and all remote locations confirming the infrastructure was in place to support the video conferencing on all hardware. Bandwidths at remote sites ranged from 100MB to 2GB in connection speed. All locations confirmed the presence of wireless Internet, except for MACU that did not have classroom-specific wireless. This has been addressed in the hardware of the grant. As part of the interactive video equipment, Sympodium touchscreen lectern monitors have been selected to allow instructors to diagram on the monitors or projectors as they discuss STEM topics. At remote sites, SmartBoards will be utilized to allow students to interactively demonstrate their work with the instructors at the HUB site.

Each of the end-user sites has either newer, aging, or no technology in place. The end-user sites have aging equipment that is not reliable, and new SmartBoards will replace this aging equipment. All sites have either older classroom computers or computers not powerful enough to handle the video conferencing software and related applications at the quality to provide for a successful program. The equipment will provide new, powerful computers to ensure high-quality streaming. None of the sites have video conferencing cameras or iPads in these classrooms. These will be purchased new for the sites.

# **Telecommunications System Plan Map/Diagram and Narrative** System Plan Map/Diagram

# The College-level Education Access for Rural Schools Sites

Map with Approximate Hub and End-User School locations

Color-coded Site and Project Role

Site	Site Role
Mid-America Christian University	Hub
3500 S.W 119th Street	
Oklahoma City, OK 73170	
Stilwell Public Schools	End-user
1801 W. Locust Street	
Stilwell OK 74960	
Alex Public Schools	End-user
209 South 2nd Street,	
Alex, OK 73002	
Binger-Oney High School	End-user
323 S Apache St.	
Binger, OK 73009	
Buffalo High School	End-user
605 S.E. 2nd Street	
Buffalo, Oklahoma 73834	

# BUDGET AS NEEDED

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#### **Objectives and Plans**

This National Science Foundation (NSF) proposal, Faculty and Institutional Accelerated Transformation (FIAT) in Mathematics and Science, is an Institutional and Community Transformation track, Exploration and Design Project intended to improve faculty teaching and undergraduate student understanding of biology, chemistry and mathematics as interdisciplinary subject matter. This project will explore the use of interdisciplinary and interdepartmental teaching and learning methods for faculty and students at Mid-America Christian University (MACU) in Oklahoma, and seeks to design crosscutting co-curricular lessons (National Research Council, 2012) linking the School of Mathematics and Science with the School of Teacher Education. Further, this project emphasizes the involvement of undergraduate students from underrepresented groups (URGs) in interdisciplinary math, science and education activities through a collaboration with Santa Fe South (SFS) Schools, a fully accredited, tuition-free public charter school district consisting of seven schools with 93% Hispanic/Latino students from the Oklahoma City Public School District attendance area serving students from Pre-K through 12th grades. URGs include "women, persons with disabilities, and three racial and ethnic groups – blacks, Hispanics, and Native Americans or Alaska Natives – who are underrepresented in fields [such as] science and engineering" (National Center for Science and Engineering Statistics [NCSES], 2017).

This project tests the theory of change that if co-curricular, interdisciplinary teaching and learning strategies and communications between faculty teaching science and mathematics and teacher education at MACU are strengthened, then the FIAT project team can transform the institution and the community it serves by increasing knowledge and self-efficacy in the subject matter. The theory of change builds on Estrada's research findings that "Co-curricular programs create engaging environments when they introduce activities or context that result in students meaningfully connecting to [Science, Technology, Engineering and Mathematics (STEM)] content...[, which], can be effective in retaining interest and persistence.... (Estrada, 2014)." Co-curricular activities also increase URM (underrepresented minorities) success rates in STEM. (Estrada, 2016).

The work plan for this project includes achieving the following objectives: (1) Improve faculty's ability to broaden participation in STEM and effectively teach interdisciplinary science and mathematics subject matter by exploring, designing, and adopting a new interdisciplinary program at MACU titled Integrating Science, Math and Education (ISME) that will improve faculty collaboration between the School of Mathematics and Science and School of Teacher Education, as well as undergraduate science and math majors, pre-service teachers, and SFS teachers.; (2) Increase the interdisciplinary communication, knowledge, self-efficacy and life-long learning of Science and Mathematics majors through peer-led teams and the use of collaborative topic investigations between disciplines, departments, and online communities; and, (3) Enhance pre-service, Pre-K-6 teachers' ability to develop curriculum and teach science and mathematics topics in high need Oklahoma school districts by collaborative learning between Mathematics and Biology majors in MACU's School of Mathematics and Science and Early Childhood and Elementary Education majors in MACU's School of Teacher Education.

A primary objective of FIAT is to transform the community served by MACU by addressing the critical shortage of teachers, and particularly math and science teachers, in Oklahoma as described in this proposal. FIAT will also serve to better prepare math and science majors who can contribute to the regional STEM workforce.

The project team's plan seeks to measure the increase in understanding of math and science subject matter of students who major in undergraduate Biology or Mathematics fields through the use of co-curricular activities. FIAT also explores whether peer-to-peer collaborations between these majors and teacher education students increases the self-efficacy of these students. Assessment and evaluation will consider: increased knowledge based on formative and summative pre- and post-tests before and following use of co-curricular activities; assessment of Mathematics and Science majors' self-efficacy through surveys before and following interdisciplinary activities; and, a demonstrated increase in the effectiveness of elementary education teachers as measured by teaching students' ability to develop age-appropriate math and science teaching lessons with peer support. This research should contribute in particular to what is known about how URG students learn, and how science and mathematics early and elementary education can be improved. *MACU does not currently offer interdisciplinary teaching and learning, co-curricular activities or interdepartmental coordination of peer collaboration*.

Although the project team has not previously been awarded an NSF grant, the diverse team of biology, chemistry and mathematics faculty at MACU in Oklahoma City, Oklahoma has been exploring new means to increase the effectiveness of teaching math and science subject matter to its diverse student body. Improving teaching and learning for the institution is critical for the student body that is made up of nearly 50% minority students and a 59% female population (National Center for Education Statistics [NCES], 2017). MACU is further driven in its mission to increase the STEM pipeline of students from Oklahoma City Public Schools and Oklahoma's underserved rural school districts by improving elementary education teaching where it essential to expose students to formal and informal STEM education. "Since interest in STEM subjects and STEM careers is largely formed by the time children reach the upper elementary and middle school level, it becomes increasingly critical that children's interest in these areas be captured and encouraged during the early to middle elementary grades, long before the point at which they enroll in courses leading to eventual career paths during high school and college (Archer et al., 2012)(Daugherty et al., 2014)." The FIAT project team will employ co-curricular and interdisciplinary teaching and learning strategies as described in this proposal that are known to be effective for all undergraduate math and science students, but will emphasize strategies that have proven successful at increasing the understanding in the subject matter and self-efficacy of URG's who are underrepresented in various STEM fields in the Oklahoma City region and in high need rural school districts. Specific Aims and related strategies that will be employed by the FIAT project team include:

Specific Aim 1: Integrate interdisciplinary, co-curricular teaching and learning at the undergraduate level. MACU's will transform introductory STEM undergraduate instructional practices to include teaching practices and collaborative learning and

communication across and within the disciplines of biology, math, chemistry, and teacher education. This program will be developed in collaboration with the School of Teacher Education and the SFS Schools. To achieve this objective, MACU's mathematics and science faculty will explore and develop the new ISME program that will involve cocurricular interventions that enhance engagement for undergraduate students with the goal of increasing the knowledge and self-efficacy of students graduating with a Biology or Mathematics major. As an example, MACU's School of Mathematics and Science faculty are seeking to explore the use of K-12 Next Generation Science Standards as a model for interdisciplinary, cross-cutting activities as developed by the National Science Teachers Association as part of its co-curricular activities so that MACU's science and math majors are able to effectively support their pre-service teaching peers in the development of K-6 lesson plans. The FIAT team will also work with robotics curriculum, since faculty has exposure to the use of Pro-Bot as used by other institutions. MACU will explore using other open-source, online tools to teach interdisciplinary use of math and science. Currently, none of these activities are in place, and faculty teach solely in their field of expertise. Since these activities are new to MACU's faculty, professional development using online tools and attending regional and national conferences is necessary. Professional development (PD) will be a key component for institutional transformation and achieving the objective of improving interdisciplinary and interdepartmental teaching and learning. In particular, faculty will require PD to learn the latest Science standards and new curriculum and co-curricular teaching and learning exercises. PD is discussed further in the project Approach section in this proposal.

Specific Aim 2: Increase the knowledge and self-efficacy of undergraduate Mathematics and Science majors and pre-service teachers through collaborative learning and mentorships. The primary strategy to increase knowledge of math and science subject matter involves developing collaborative learning groups (Lenning and Ebbers, 1999) within these disciplines to increase students understanding of this material. Goals include: Faculty will increase the use of interdisciplinary, interdepartmental and co-curricular lesson plans through ISME; Faculty will promote collaborative learning groups for students within the math and science disciplines to increase student knowledge, understanding and self-efficacy in the subject matter; Faculty will develop and foster mentor relationships between students and faculty; and, pre-service teachers will enhance self-efficacy through the involvement in the ISME program. Although pre-service teachers enroll in a science methods course they do not collaborate with scientists outside of the formal classroom. ISME will provide that opportunity.

**Specific Aim 3: Increase Science and Math Curriculum for pre-service and K-6 teachers.** As part of the FIAT team's strategy for increasing the knowledge and self-efficacy of Mathematics and Science majors, faculty will match students using specific subject content to develop collaborations between MACU's Mathematics and Science majors and pre-service teachers. In addition to the interdepartmental collaboration, the collaboration will extend to the Santa Fe South public charter schools. With faculty guidance, the Mathematics and Science majors will co-develop a STEM Inquiry-based lesson every semester and the lesson plan will be left with the host SFS school for current teachers and teachers-in-training to use for future classes. Lesson plans will in part

consider Next Generation Science Standards (NSTA, 2013) curriculum and STEM curriculum based on Piaget's model of intellectual development (Ojose, 2008) as requested by the FIAT collaboration's SFS school teachers, and others who teach in regional K-12 schools. The FIAT team posits that these collaborations will increase STEM interest, enhance partnerships between schools (school systems and the university), expand exposure to inquiry-based science for K-6 students, and create a pipeline of well-trained elementary education teachers in Math and Science disciplines. A potential future goal is to create a model that involves the family and friends (community transformation) of the K-6 students using Citizen Science (2018). Goals under this aim revolve around: increasing STEM K-6 teaching capacity through interdisciplinary collaboration between pre-service Elementary Education majors and Mathematics and Biology majors and science and math faculty, and SFS classroom teachers; and, expansion of student communities to co-develop age-appropriate teaching K-6 lessons in STEM to teach at local schools with high URG populations and to support current teachers, especially those with emergency certifications within the school systems. The project will primarily support SFS Schools, which includes a total of seven schools including four elementary schools, and is 93% Hispanic/Latino, 3% White, 2% Two or more races, 1.5% Black, with the remainder of students of Native American, Asian or Pacific Islander descent. FIAT will primarily serve 1,429 students in the SFS K-6 schools annually, with the goal of expanding to 7-12 grades in the future. The initial cohort of 89 MACU math, science and education students supported by FIAT includes nearly 30% Hispanic/Latino, 53% White, 4.5% Two or more races, 3.4% Black and 3.4% American Indian students, with the remainder from unknown or other races. MACU students will serve as cultural border crossing tour guides to the SFS students in math in science, as Western science is considered a culture of its own (Aikenhead, 2001)

#### Significance of Project and Rationale

As a result of shortages in the regional STEM workforce, this is a critical time in Oklahoma to increase the number of students interested in majors in math, science and other STEM fields. The significance of this project is that it offers an innovative approach to addressing the regional shortfall in the pipeline of students who are interested in STEM fields and who have the appropriate math and science education necessary to pursue careers in these fields. The rationale for this project is that FIAT can accomplish this goal by exploring and designing co-curricular activities that improve how math, science and other STEM curriculum is taught to more than 4,000 elementary school student in SFS Schools, and to undergraduate students with an emphasis on URG's. The project helps address both the shortage of qualified math and science teachers to increase the pipeline of STEM-focused students, and the interest, understanding and self-efficacy of undergraduate students who are prepared to fill the regional STEM workforce shortage.

**Oklahoma Teaching Workforce Gap**: Despite an average of \$5,000 annual increase in teacher base pay that occurred in 2018 to increase the number of certified teachers, the Oklahoma State Board of Education was forced to issue a record high number of emergency certifications for school teachers (Oklahoma State School Boards Association [OSBBA] Survey, 2018). OSBBA reports that elementary school science and math positions are among the hardest to fill, and the State is not producing enough of these

teachers to replace those who leave the profession or the State (OSSBA, 2018). The STEM workforce shortage is exacerbated by a State crisis in recruiting teachers, including in the SFS Schools where many teachers have emergency certifications and may lack the background to develop appropriate STEM curriculum. Through FIAT, MACU's pre-service teachers will be able to assist some of the emergency certified teachers by developing curriculum, and will also be far more qualified to fill open teaching positions, and have the ability to teach math and science.

Oklahoma City STEM Workforce Gap: A review of ASTRA's 2018 Oklahoma "STEM and Innovation Report Card" finds that of the 233,000 new STEM jobs in the 40 fastestgrowing fields projected for the [State of Oklahoma] over the next decade, nearly 81,000 (35%) are positions requiring at least some degree of postsecondary competence in (primarily health fields) and over 43,000 (19%)biology are engineeringintensive specialties that require a thorough grounding in postsecondary math. (ASTRA, 2018)." The Oklahoma Employment Security Commission reports that "there are not enough workers to meet these demands." (OESC, 2017) Yet, the NSF reports that "The representation of certain groups of people in science and engineering (S&E) education and employment differs from their representation in the U.S. population" (National Science Foundation, 2017), which further limits the ability of employers to fill these jobs. MACU seeks to increase interest and understanding of STEM disciplines to help fill this workforce gap over the next decade by better preparing MACU's Mathematics and Science majors, pre-service teaches and current teachers at SFS School, and K-6 students at SFS schools. The FIAT project can help address projected shortages in high need fields in Oklahoma, which include fields such as Geosciences, Mathematics, Computer Science, Environmental Science and Life Science, which are the fastest projected growth fields between 2014 and 2024 (OESC, 2017). FIAT also seeks to increase the pipeline of students with an interest in math and science from an early age through training in pedagogy for elementary school teachers with future plans to extend the developed partnership with SFS Schools to include junior high and high school level curriculum.

MACU reflects a diverse population and can significantly contribute to an increase in URG's choosing a STEM major and persisting to degree. MACU's undergraduate student population by gender consists of 59 percent women and 41 percent men. Its population of 2,558 students includes nearly 23% African Americans, 6% Latino and 4% American Indian among other races (NCES, 2017). FIAT explores and designs curriculum that will increase the self-efficacy, knowledge and cross-disciplinary communication and proficiency of these URGs. With a student to faculty ratio of 12:1, MACU dedicates substantial co-curricular support to URG's with limited resources. The theory of change for this project aligns with the rationale for achieving the Specific Aims:

Alignment with Specific Aim 1: Improve interdisciplinary, co-curricular teaching and learning at the undergraduate level. With the understanding that biology and mathematics has a wide variety of specialized topics, MACU will use resources to improve pedagogy that enables students to demonstrate knowledge and understanding of the following core components: Crosscutting concepts that integrate mathematics and science are necessary for developing an integrated, scientifically-based view of the world. Crosscutting concepts include patterns; cause and effect; scale, proportion, and quantity; systems and system models; energy and matter; structure and function; and stability and change (National Science Teachers Association [NSTA], 2014).

Further, MACU's interdisciplinary faculty team will assess student teams by collecting and interpreting quantitative and qualitative data from the peer collaborations utilizing well tested theories involving science and mathematics concepts. Summative assessments will be conducted at the end of each semester and formative assessments will be conducted quarterly by the PI and CoPIs to assess the curriculum content created by each science/math and education student team. Criteria for theses assessments may include creating age appropriate curriculum based on science and math topics that allow hands-on learning and data collection from K-6 students. These collaborative teams will be taught by faculty to emphasize in the lesson plans the understanding that the field of science is a human endeavor, that the Nature of Science is tentative, and that science relies on evidence based explanations.

Another strategy that MACU will employ is the use of Journal Clubs. Journal clubs have been shown to increase student confidence in "accessing, analyzing, and reporting scientific research" and improve students' "confidence and performance in their courses" (Sandefur & Gordy, 2016). Students will be required to log the amount of time that they participate in co-curricular activities including using the computer lab and simulation programs, participate in Learning Communities, and attend required and voluntary FIAT activities. Learning Communities will be developed using discussion boards on Desire2Learn (D2L, 2018), this online resource can be accessed 24 hours a day, 7 days a week and open to all stakeholders including SFS school teachers. Learning Communities... have been found to provide benefits for students and faculty including "higher academic achievement, better retention rates, diminished faculty isolation, and increased curricular integration" (Lenning & Ebbers, 1999).

In addition to improving undergraduate students' understanding and employment of crosscutting concepts, the goals of the FIAT program will be to substantially strengthen the ability of students to conduct critical analyses, develop high-level math and science skills to solve a "real-world" problem that requires interdisciplinary problem-solving capabilities and effectively communicate math and science topics to all stakeholders. The program will increase the effectiveness of college students' ability to serve as peer mentors in subject matter that is consistent with their majors and potential further academic or career discipline. The subject matter should also serve to increase interest and persistence in STEM-related fields for students by promoting the use of cocurricular learning, which has been shown to be an effective tool for increasing persistence, particularly among URGs (Estrada, 2016). Aikenhead (2001) uses the analogy of a teacher as a cultural tour guide, as URG students cross cultural borders in the discipline of science. Student mentors can be trained to help their pre-service teacher education peers develop age appropriate lessons for K-6 students at SFS schools.

# Alignment with Specific Aim 2: Increase the knowledge and self-efficacy of undergraduate Mathematics and Science majors and pre-service teachers through

**collaborative learning and mentorships**. FIAT will enable MACU's faculty to enhance undergraduate Mathematics and Science majors knowledge of the subject matter and selfefficacy through interdisciplinary collaboration, peer-to-peer mentoring and laboratory support and faculty-to-student mentoring and tutoring. These shifts in knowledge and self-efficacy will be achieved by implementing new teaching and learning strategies, including the FIAT math and science interdepartmental program. This transformation will be implemented throughout the project period and beyond.

In addition to using co-curricular, interdisciplinary and interdepartmental approaches to teaching and learning throughout the semester, MACU students and science and math faculty will visit as necessary SFS Schools to meet elementary school teachers to understand their needs for math and science lesson plans. This activity will be coordinated between the FIAT Coordinator and the SFS Coordinator as described in a memorandum of understanding between MACU and SFS schools and demonstrated by the Letter of Collaboration. Additionally, D2L will serve as a launching point for sharing ideas, needs, and content as it relates to the goals of FIAT. A critical element under Specific Aim 2 is to develop a mentoring community for faculty to students and a collaborative learning community from students to their peers. Twenty MACU students will be initially selected beginning in the fall of 2019, and each academic year thereafter, based on a grade point average above 3.0, responses to a questionnaire, and a faculty recommendation. Math majors will have completed Calculus I and Science Majors will have completed BIO I and II and Chem I. These students will receive an hourly stipend for serving as peer collaborators as will MACU pre-service teachers to incentivize their participation in FIAT. A key objective of the FIAT program is for Science and Math students to learn to work with their pre-service teacher peers. Peer collaborators will be trained through a faculty-led seminar that takes place during two-hour sessions over a three-day period at the beginning of each semester that conveys the co-curricular activities that will be developed by the FIAT project team. These math and science majors will work with pre-service teachers in MACU's School of Teacher Education under the supervision of faculty. All undergraduate biology and math students who meet the criteria will be offered the opportunity to serve as peer collaborators. MACU faculty and a FIAT Coordinator will match the teams according to the SFS teacher's curriculum request. The PI and Co-PIs will monitor the teams throughout the program

MACU's peer collaborators will learn NSF-supported Peer-Led Team Learning (PLTL) techniques (Gosser et al., 2001) to assist pre-service teachers. These pre-service teachers will in turn work with the teachers in Oklahoma City and within the rural school districts who benefit from the FIAT Project. FIAT will promote interactions with peer mentors inperson or online as necessary. Pre-service teachers will be encouraged to meet with current elementary school teachers in person as feasible, and have continual online access.

Alignment with Specific Aim 3: Improve teaching and learning of mathematics and science at the early childhood and elementary education level. A final objective for this project is to transform the teaching of math and science instructional practices to include teaching practices and collaborative learning and communication at the K-6 level. While transforming teaching pedagogy and application of science and math content at the

undergraduate level, the project team will also seek to transform teaching and learning at the early childhood and elementary school level at SFS Schools. The long-term goal is to plug the leaky pipeline of students who lose interest in math and science during their K-12 education. MACU's collaboration with the SFS Schools is a critical element to improving undergraduate math and science education by providing a co-curricular assignment for these students that leads to improved teaching, learning and self-efficacy for early childhood and elementary education. Goals under Aim 3 for the FIAT project team include: exposing college students to teaching concepts, including PLTL, crosscutting practices, and mentoring strategies; Faculty will work in collaboration with local school districts, but primarily SFS, including providing PD to enable pre-school and elementary school teachers online learning options with mentoring relationships to effectively teach age appropriate STEM subject matter.

MACU boasts a dedicated team of faculty and staff that focuses on providing the highestquality student support services. Further, development of these interdisciplinary, interdepartmental and school system collaborations are fully supported by MACU's administration, including the institution's academic leadership and president. MACU's faculty will supervise both the peer mentors and students who participate in the collaborative program between the Mathematics and Science Department and the Education Department. An NSF grant will enable MACU's faculty to explore and design co-curricular curriculum and train and prepare college students to serve as peer collaborators. A stipend will for these students will help ensure participation in the program and offset costs for the many low-income students who attend MACU.

#### Approach

This project is an Exploration and Design Project since it provides preliminary data for the research team to assess the effectiveness of interdisciplinary and interdepartmental teaching and learning between Mathematics and Science faculty and students and Elementary Education majors. This research will be used to assess whether participating in this type of peer collaboration through ISME promotes knowledge of math and science subject matter for FIAT Mathematics and Science major peer collaborators, and if it increases their self-efficacy as Mathematicians, Scientists and Educators. Through FIAT, MACU is seeking to advance what is known about undergraduate teaching and learning, and to support both traditional school districts and a Latino majority school district. By training pre-service teachers through peer mentoring, the project team can assess whether this support improves the ability of pre-service Elementary Education students ability to prepare lessons to teach math and science. The research will also assess build knowledge around how pre-service teaching students understand, learn and teach this subject matter.

The FIAT project team's approach (Fig. 1 below) to implementing the project plan entails these strategies: Coordination of interdisciplinary and interdepartmental activities between Mathematics and Science Department faculty and between this department and MACU's School of Teacher Education through ISME; Professional development to improve new interdisciplinary, cross-cutting curriculum; Hiring and training peer mentors; and, Recruiting Math and Science majors and Elementary Education majors to work together to develop interdisciplinary lesson plans that are needed by SFS; and,

Coordinating lessons with the SFS School teachers. Below is the FIAT concept map, which shows MACU's approach to working in collaboration with the SFS Schools during the project period.



Figure 1.

Faculty Coordination – A critical element of this proposal is to improve communication and cooperation between Mathematics, Biology and Chemistry faculty at MACU with a focus on identifying and expanding interdisciplinary pedagogical activities to improve teaching and learning for Mathematics and Science majors. In addition to improving interdisciplinary educational activities through ISME, Mathematics and Science Department faculty will collaborate with faculty from the School of Teacher Education to coordinate peer mentoring and the development of transformative curriculum. The new curriculum promotes self-efficacy through applications of real-world scientific content that can be explored by Math and Science major student mentors in collaboration with their pre-service teacher peers. These interdisciplinary and interdepartmental activities will be developed and implemented by the PI, Dr. Harold Kihega (Biology) and Co-PI's Dr. Carol Fowlkes (Mathematics) and Dr. Deshani Fernando (Biology and Chemistry) in coordination with Dr. Vickie Hinkle, Assistant Co-Director of the School of Teacher Education and Director of Student Teaching. Coordination activities will include once weekly meetings between Mathematics and Science Department faculty, and bi-weekly meetings with Dr. Hinkle to discuss co-curricular activities and projects. A part-time FIAT Coordinator will be hired by the PI to coordinate and schedule peer collaborations between math and science faculty and teacher education faculty, and with SFS Schools.

Professional Development – PD will allow MACU faculty to build on their knowledge of developing and implementing crosscutting science and education content. For this reason, the project PI and Co-PI's will each attend conferences and participate in online training at appropriate times during the academic year or summer months. Faculty will each attend at least one conference annually such as the National Science Teachers Association Conferences on Science Education, the Association of University Biology Educators, the Association of Mathematics Teachers Educators, National Council of Teachers of Mathematics, and they will learn new curriculum and rubrics through online training modules such as Next Generation Science Standards (2013) for grades K-12.

Recruitment and Training of Peer Collaborators – Beginning in the summer of 2019, MACU intends to recruit MACU sophomores, juniors, and seniors for the initial peer collaborator positions (Group 1) for the fall semester of 2019. The application process will be repeated prior to the beginning of the second program academic year, and peer collaborators, will be selected for the second program year with this process repeating through completion of the third project year. Selected students will have the option of continuing each academic year through graduation. Students with a science or math major will be contacted by the Principal Investigator (PI) and Co-Principal Investigator (Co-PI) upon award notification to assess their interest in becoming a peer collaborator. MACU currently has a total of 89 students that will benefit from the collaborative team relationships. Peer collaborators will be selected based on their experience and commitment to a math or science major offered by MACU. Initial training of peer mentors will take place each year over a three-day period at the start of the semester. Should a mentor leave the program, they will be replaced at the beginning of the next semester, or during the semester if time permits for the project leadership team.

Recruitment of Early Childhood and Elementary Education students (Dr. Hinkle might offer more feedback for this paragraph) – Participation in FIAT will not be a required part of pre-service Elementary Education major requirements. As a voluntary program, all 43 Early Childhood and Elementary Education majors will be encouraged to participate in the program. Each student who agrees to participate will be assigned either a Mathematics or Biology major peer collaborator who has been hired and trained to work in the FIAT program. The mentor and mentee will be provided with a schedule template so that they can arrange weekly meetings in person or online to discuss strategies for preparing Mathematics and Science lessons. Participants will receive a stipend for their service and benefit from learning to develop STEM lesson plans.

Recruitment of Mathematics and Science majors – Although relatively new accredited majors at MACU, with Mathematics starting in 2008 and Biology starting in 2016, MACU has 8 Mathematics majors and 38 Biology majors who will work with the 43 preservice teachers. MACU is currently working toward accreditation for Chemistry majors.

Although, recruitment of female Mathematics majors has lagged with only one current female major, approximately 40% of Mathematics and Biology majors are from URM's. MACU has the ability to increase URG and particularly female and AI participation in FIAT, as MACU faculty are representative of these groups.

Activity	Lead Person(s)	Year 1	Year 2	Year 3	Year 4
1. Inform MACU STEM and Education	PI/CoPIs	X			
		N/	V	V	
2. Recruit Undergraduate Students	PI/CoPIs	X	X	X	
3. Visit and Review SFS Teacher Needs	PI/CoPIs/Students	X	Х	Х	
4. Develop Curriculum	Student Teams	Х	Х	Х	
5. Monitor ISME for Improvement	PI/CoPIs	Х	Х	Х	
6. Evaluation Activities	PI/CoPIs/External				
	Evaluator	Х	Х	Х	
7. Develop to expand ISME to other K-6	PI/CoPIs				
schools and 7-12 grades				Х	Х

The Timeline of Activities for implementing the approach is as follows:

## Assessment and Evaluation Measures

Rather than emphasizing retention and persistence to degree, which remains above 90% for MACU's Mathematics and Biology majors, the project team has chosen to focus on assessing whether FIAT has achieved its objectives based on the following research questions: (1) Does using ISME as a co-curricular, interdisciplinary approach to teaching by faculty to undergraduate Mathematics and Science majors, and from these students to pre-service educators increase the knowledge of all the Mathematics and Science majors in understanding the subject matter, particularly among URG students?; (2) Does using ISME to improve the approach to teaching and learning lead to greater self-efficacy of undergraduate Mathematics and Science majors in their ability to understand and apply the subject matter?; and, (3) Does ISME's peer-to-peer collaborations<del>, and stipend incentives</del>, increase the self-efficacy of pre-service science and mathematics educators? The overall objective of the FIAT project is to improve students' understanding and employment of crosscutting concepts, or concepts that are applied across all domains of science and hence necessary for developing an integrated, scientifically-based view of the world.

To assess objective 1 (increasing the knowledge of math and science, and pre-service education undergraduates) the FIAT team will adminster a pre and post test to evalute student knowledge of subject content before and after ISME activities. Further, pre and post surveys will be admistered to participants using a Likert scale to assess areas of improvement in the approach and learning techniques of IUSE. .conduct an Entrance questionnaire and an Exit questionnaire at the beginning and at the end of each semester for the freshmen students. The entry and exit questionnaire will have the same questions with a Likert scale to assess their interdisciplinary knowledge in math and science.

To assess objective 2 (increase self efficacy in subject content) a second assessment method will use both formative and summative assessments of written reports based on real world science topics and learning outcomes related to appropriate subject content that will be administered to set a grade point to evaluate the student's knowledge while also considering their ability to understand and use the interdisciplinary subject matter. Learning outcomes will be developed by the FIAT team after the establishment of SFS teacher's curriculum needs. The written report will allow the students to explain their knowledge about particular subject matter in different disciplinary perspectives (such as math, chemistry, biology and education). The grading rubric for this assignment will allocate points based on learning outcomes of that activity. At least two to three of these types of assignments will be given during the semester to understand the progress of the co-curricular, interdisciplinary approach to teaching and to evaluate the development of the knowledge in the individual student. The team will also use a survey administered to the SFS teacher concerning the development and teaching of the interdisciplinary lesson this will be taken after every lesson to make the required modifications for future lesson planning. use Science Teaching Efficacy Belief Instrument (STEBI, 2018)

A, B and NWEA assessments (NWEA, 2018) to test this knowledge.

To assess improvements in the approach to teaching and learning, the FIAT team will provide a pre-survey and post survey in the beginning and at the end of the semester with a Likert scale. The team will assign a **group project** to the undergraduate Mathematics and Science majors to address a "real-world" scenario in an interdisciplinary approach. This assignment will get

To assess objective 3 (an increase in pre-service teachers self-efficacy to develop science and math curriculum) The FIAT team will administer the Science Teaching Efficacy Belief Instrument-Preservice (STEBI-B). STEBI-B will be used to assess whether peer mentoring increases the self-efficacy of pre-service science and mathematics educators. This instrument will be administered prior to the incorporation of ISME methods and at the end of the semester. This measuring instrument was developed in 1990 and has been used in numerous studies concerning teachers' self-efficacy. FIAT will observe whether the STEBI-B instrument has validity and reliability related to ISME. Only the pre-service teachers will be measured with STEBI-B. Further, the project team will also assess whether tutoring and mentoring of MACU pre-service teaching students by peer Mathematics and Science majors increased the math, science, and education majors selfefficacy in related content. Pre- and Post Interviews with pre-service educators will be coordinated with the School of Teacher Education.

To assess whether teaching of STEM-related lessons to K-6 students increases the elementary school students' interest and knowledge in math and science, the project team will ask K 6 students to write a sentence or draw an image about a matter (object) that is related to the lesson topic. This can be done in the beginning and at the end of the class session and can be used as a formative assessment to check their knowledge before and after the lesson. In addition, the project team will observe student behavior during the lesson time. This can be done by another pre service teacher or the K 6 elementary

teacher. A. R. Jolley et al. (2015) discussed the observation method in "Living With Volcanoes: Cross-Curricular Teaching in the High School Classroom." The observation method can be adapted to FIAT to assess the interest of the K-6 student about the lesson taught by pre-service teacher who incorporates science into the lesson plan.

The project team will use surveys to assess whether the lessons plans prepared by preservice teachers in collaboration with STEM major students at MACU meet the requirement of the of K-6 teachers while increasing the effectiveness of elementary education teachers. The team will also collect feedback from K-6 teachers,

Since URGs are the target of this program and to answer the question of URG's knowledge increasing the team will conduct an Analysis of Variance by gender (do females increase their knowledge at a different rate than males in STEM using cross-cutting techniques?) and will also conduct an Analysis of Variance by ethnicity (do American Indian, African American, Hispanic students increase knowledge at a different rate?). This data will answer as a whole whether there are statistically significant mean differences in students' interactions by gender or ethnicity.

Dr. Deshani Fernando will prepare and collect the assessment data in coordination with the PI and Co-PI. The project team has identified an External Evaluator, Dr. Renee Blumstein, who has similarly worked with Oral Roberts University to validate NSF research data. Dr. Blumstein will participate review research protocols and prepare a final evaluation report to confirm the validity and reliability of the data.

# **Critical Risks and Challenges**

There are limited risks associated with this Exploration and Design project. However, the following risks and challenges can be mitigated as described below:

Assessment and Evaluation risks – MACU is small institution so sample sizes are a challenge. However, this project will impact nearly 90 MACU students and over 4,000 SFS School students during the three-year project period. The assessment and evaluation will focus on whether FIAT participants increase their knowledge of STEM content and their self-efficacy in being able to use the subject matter either in the STEM workforce or as STEM teachers. Formative and summative assessments and surveys will need to be designed for the FIAT project, and the project team has started to explore course content that be used, including STEBI.

Professional Development – It is the desire of MACU faculty to become more involved in training in teaching co-curricular, interdisciplinary and interdepartmental strategies that increase effectiveness for teaching undergraduate students. The project team has identified specific training that will benefit the team and lead to institutional transformation for MACU's faculty, students and the community. PD will primarily take place during summer months, or during the semester if this leave does not interfere with the PI or Co-PI's course load. Recruitment of peer collaborator risks - Student participation may vary semester to semester. The initial year project will seek to identify ten Mathematics and ten Science majors, which is feasible from among the nearly 50 current math and science majors. The program can be scaled to include more student participants if there is great interest. In addition, Pre-service elementary education students may be reluctant to participate if the interdepartmental peer mentoring is not mandatory. This will be mitigated by coordination between the department faculty, and by seeking a minimum of 10 preservice teacher participants from among 43 in the first year as the project is developed. The stipend will also help encourage participation. Should a peer collaborator drop out of the program, the PI and Co-PI's will seek to replace the opening during the semester. The opening will be filled at the beginning of the following semester if necessary.

Faculty Departures – While the PI and Co-PI's are Mathematics and Science Faculty members include the Co-Chairs of their department, there is always a possibility that a team member will leave for a variety of reasons. If this occurs, a Co-PI will serve as interim PI, or the PI or Co-PI will temporarily fill the role of a Co-PI who departs until the institution fills these roles.

# FIAT Project Team:

The FIAT project requires interdisciplinary teaching within MACU's School of Math and Science. The Principal Investigator (PI) for the project, Dr. Harold Kihega, Associate Professor of Biology, and the Co-Principal Investigators (Co-PI), Dr. Carol Fowlkes, Professor of Mathematics are both Chairs within the School of Math and Science. Dr. Kihega and Dr. Fowlkes will be responsible for all aspects of implementing the project including: professional development, teaching cross-cutting concepts to science and math majors who will serve as peer mentors; monitoring mentors to ensure they are effectively delivering the learning module content; collecting all formative and summative data designed by the PI and Co-PI through STEBI; developing and administering surveys to assess the qualitative impact of the program; preparing and reporting all quantitative and qualitative data collected from the FIAT project for publication on MACU's website for consideration by faculty peers at other institutions.

Dr. Kihega and Dr. Fowlkes will work with MACU's chemistry faculty member, Dr. Deshani Fernando, Dr. Fowlkes has experience in K-12 education and Dr. Fernando has an advanced degree in chemistry, with responsibility for teaching and project assessment. In this capacity, Dr. Fernando will help prepare and collect tests and data and ensure that assessment data is accurately analyzed. The External Evaluator consultant, Dr. Renee Blumstein, will independently review and report project data.

Dr. Kihega is a member of the Otoe-Missouria Tribe. MACU currently has a professional service agreement with the Otoe-Missouria Tribe to offer the Otoe-Missouria Tribe Summer STEM Camp at MACU. In addition, Dr. Kihega has three years of K-12 teaching experience as a Biology teacher. His role as PI is particularly important as an underrepresented minority, and as a role model for Native American students. Furthermore, the Tribe has supported his work by investing in critical laboratory supplies

at MACU. This includes microscopes for two different lab rooms, anatomical models and dissecting equipment. Dr. Kihega's goal is aligned with the research objectives of this grant, to increase interest within Science and Math disciplines for minority populations in specified school districts in Oklahoma.

The Co-PI for FIAT, Dr. Fowlkes, has nine years of K-12 teaching experience as a secondary math teacher. Because of her passion for teaching and for math, a strong connection to promoting secondary math education is prominent. Highly qualified math students are strongly encouraged to go into secondary math education in the math courses she teaches, and adjuncts are encouraged to promote this shortage area as well.

Dr. Fernando, also a Co-PI, brings more than five years' experience teaching Chemistry for undergraduate students. She also worked as a Research Scientist and Graduate Research Assistant where she trained and mentored several undergraduate and graduate students to do research. With her expertise in the field of Chemistry, she is able to improve the chemistry knowledge and interest of the students' while helping them to understand the world around them.

**Intellectual Merit:** FIAT will transform current teaching practices at Mid-America Christian University, particularly in the areas of collaborative learning between students dedicated to different areas of study (STEM and education), and will drastically improve faculty communications across disciplines (biology, math, chemistry, and education). It will also address the ominously low numbers of STEM graduates in the US by increasing STEM curricula for teachers and underserved PreK-6 students in high need, diverse school districts. STEM majors will gain experience in analyzing and applying STEM topics and communicating across disciplines. Additionally, the undergraduate pre-service teachers gain additional experience in STEM content that is beyond what is taught in the typical education classroom. Other FIAT developments include: peer-to-peer, faculty-to-student, and faculty-to-faculty collaborations, undergraduate exposure to data collection and research, community development between the university and Oklahoma K-6 schools, and faculty mentoring. Other FIAT merits may be exposed as the program enlists a wide diversity of students and faculty.

**Broader Impact:** One of the strengths of MACU is the diversity in STEM faculty, each of the faculty involved in this project are URGs in STEM. The FIAT model also offers undergraduate students experiences that are not typical of the customary classroom. Future plans to build upon the FIAT model include expanding the collaboration to other disciplines and to expand to more K-6 schools. Overall, the requesting K-6 teacher keeps the developed STEM curriculum to utilize in future courses. Each pre-service teacher and STEM major gain experience in crosscutting curriculum development and become experts in certain STEM content areas. The pre-service teacher develops a higher self-efficacy teaching within the area of STEM, and the supervising K-6 teacher gains access to STEM lessons to share with peer teachers and use in future teaching modules. The MACU pre-service teacher and STEM major will also present their work at the annual Research Day held on the MACU campus (K-6 teachers, students and parents will be

invited to attend). Ultimately, each FIAT team will develop a journal-ready paper to submit to a peer-reviewed journal for dissemination.

## Conclusion:

The goal of MACU's FIAT project is to increase interest in and undergraduate student knowledge and self-efficacy in Mathematics and Science, particularly for URG's, in an effort to fill the shortage of science and math teachers in Oklahoma and to help build the next generation of the STEM workforce. NSF grant funds will enable the project team to explore and design the use of crosscutting curriculum taught by faculty to assess whether this curriculum leads to self-efficacy for Mathematics and Science major peer mentors and pre-service teacher mentees. The project will seek to transform MACU as an institution, the SFS Schools, and the greater Oklahoma City community by addressing the needs of underrepresented groups targeted by this research and the institution.



# MEMORANDUM OF UNDERSTANDING 3+1 Program

Effective with the 2020-2021 academic school year, this Memorandum of Understanding ("Agreement") establishes the 3+1 Program between Mid-America Christian University (MACU) and Oklahoma State University – Center for Health Sciences (OSU-CHS), College of Osteopathic Medicine on October 26, 2020.

OSU-CHS seeks to admit students with a strong desire to practice in Oklahoma with a preference given to applicants who are interested in serving rural and underserved communities. The 3+1 Program allows students to complete their pre-doctoral medical training in seven years by completing three years of undergraduate education at Mid-America Christian University (MACU) and four years of medical education at OSU-CHS. Students apply to the 3+1 Program in their sophomore year of college. After completing the first year of medical school and meeting the academic requirements listed in *Exhibit A*, MACU will award an undergraduate degree to students accepted in the 3+1 Program.

To qualify for the 3+1 Program, applicants must meet the following requirements:

- Major in Biology;
- Overall grade point average (GPA) of at least a 3.5 and a 3.5 Science GPA at the time of application to OSU-CHS;
- Meet the academic requirements specified in *Exhibit A*. Courses earned as concurrent enrollment or received AP credit will be accepted.
  - Science GPA will be calculated with the course subject categories defined by American Association of Colleges of Osteopathic Medicine Application Service (AACOMAS);
- Completed 45 or more credit hours toward a bachelor's degree at the time of application to OSU-CHS;
- Submit a complete application for admission through the American Association of Colleges of Osteopathic Medicine Application Service (AACOMAS) by February 28 of sophomore year;
- Submit a complete secondary/supplemental application for admission by March 30 of sophomore year;

- Submit two letters of recommendation: One letter from a MACU Advisor and one letter from a physician\* (D.O. preferred);
- Conduct a personal interview with the OSU-CHS Admissions Committee during the spring semester of sophomore year.

\*For the 2020-2021 application cycle, the second letter of recommendation from a physician is optional.

Students must meet with their Academic Advisor at MACU to create an academic plan for the approved 3+1 Program to ensure they will meet the requirements for their undergraduate degree and the 3+1 Program before matriculation to OSU-COM.

Students who meet these requirements will be eligible for the 3+1 Program. Students must check the appropriate box on their secondary/supplemental application to indicate they have met the 3+1 Program requirements. Following an in-person interview, the Chair of the Admissions Committee or Director of Admissions will notify applicants of the Admissions Committee's decision. The applicant will either be granted provisional early acceptance into the 3+1 Program or be invited to apply for admission as a traditional applicant in a later application cycle.

To maintain continued acceptance into the OSU-CHS 3+1 Program, provisionally accepted students must satisfy the following requirements:

- Maintain an overall grade point average (GPA) of at least 3.5 and a science GPA of at least 3.5. GPA will be calculated at the time of application and upon completion of their undergraduate degree coursework before the student matriculates to OSU-CHS;
- Submit a qualifying score of at least a 492 on the Medical College Admission Test (MCAT) by April of their junior year.
- Complete all remaining undergraduate coursework required for the approved 3+1degree plan during their junior year at MACU;
- Request in May of junior year transcripts from MACU indicating that the student has met all academic requirements for the 3+1 Degree Plan as outlined in *Exhibit A*;
- The Chairperson of the Science/Math department or designee will provide documentation indicating the student has met the academic requirements by the end of the student's junior year; and
- The Chairperson of the Science/Math department or designee will provide documentation stating any student violations or conduct issues on the student's record in May of their junior year.

After completing the first year of medical school at OSU-CHS and before enrolling in courses for the second year of medical school, 3+1 Program students must:

 Apply for graduation to Mid-American Christian University by March 15<sup>th</sup> to be included in the spring commencement ceremony. Students will not officially graduate in May until the degree is conferred in the summer, but they can participate in the ceremony.

OSU-CHS reserves the right to periodically review the Agreement and recommend changes as deemed necessary. In the event OSU-CHS makes recommendations, MACU will have thirty (30) days to accept or reject the proposed changes. Agreements will be reviewed annually for any updates on majors and academic requirements for approval. Agreed-upon changes to the Agreement will become effective for the incoming undergraduate class for the following academic year.

For any current application cycle, OSU may adjust in academic plans on a case-by-case basis with the mutual agreement of both parties, including the Assistant Dean for Enrollment Management at OSU-CHS and the Chairpersons of the School of Science and the School of Mathematics at MACU.

Both programs have the right to terminate the Agreement at any time with thirty (30) days' notice.



Oklahoma State University – Center for Health Sciences College of Osteopathic Medicine

MAJUMA

Kayse M. Shrum, D.O. President, OSU - Center for Health Sciences Dean, OSU College of Osteopathic Medicine

Eric J. Polak, M.B.A., C.M.P.E. Vice President for Administration and Finance Date 11/5/2020

Date 11/5/2020



**Mid-America Christian University** 

John Fozard, Ph.D. President, Mid-America University

Sharon Lease, Ph.D. Vice-President for Academic Affairs

Date

Date Mar. 4, 2020

# Exhibit A: Academic Requirements

To qualify for the 3+1 Program, Oklahoma State University - Center for Health Sciences (OSU-CHS) and Mid-American Christian University agree that applicants must complete the following academic requirements for program consideration:

	Bio	logy	
	Freshme	n Year***	
	Fall Semester		Spring Semester
BIOL 1214	Biology I for majors (with lab) *	BINT 1223	Introduction to the Bible
ENGL 1103	English Composition I*	BIOL 1314	Biology II for majors (with lab) *
MATH 1513	College Algebra (or higher math)	COMM 1103	Fundamentals of Public Speaking
POLS 1103	National Government	ENGL 1203	English Composition II*
UNIV 1121	First Year Evangel	MATH 3703	Introduction to Statistics
	14 Hours		16 Hours
	Sophom	ore Year	
	Fall Semester	-	Spring Semester
BIOL 2114	General Zoology (with lab)	BIOL 2214	General Botany (with lab)
BIOL 3114	Human Anatomy (with lab)	BIOL 3214	Human Physiology (with lab)
CHEM 1105	General Chemistry I (with lab) *	CHEM 1205	General Chemistry II (with lab) *
MATH 2114	Calculus I & Analytic Geometry	PHYS 2104	Physics I (with lab) *
	17 Hours		17 Hours
	Summer **		
BIOL XXXX	Course Slot Open (as needed)		
PSYC/ENGL	Course Slot Open (as needed)		
	7 Hours		
	Junio	r Year	
	Fall Semester	Spring Semester	
CHEM 3103	Organic Chemistry I*	BIOL 3363	Evolution
CHEM 3102	Organic Chemistry I Laboratory*	BIOL 4213	History of Science
HIST 2103 or 2203	American History I or II	BIOL 4314	Embryology (with lab)
PHYS 2204	Physics II (with lab)*	BIOL 4501	Biology Research
THEO 3733	Life and Ministry of Jesus	CHEM 3203	Organic Chemistry II*
		CHEM 3202	Organic Chemistry II Laboratory*
Los ana an	15 Hours		16 Hours

\* Prerequisites courses required for the 3+1 OSU-CHS program.

\*\*Summer between Sophomore or Junior year is set aside for student hardship. This will give a student an opportunity to catch up due to unforeseen circumstances, or opportunity to fulfill graduation requirements.

\*\*\*Rationale for Freshman Year: The School of Science/Math believes that a less "loaded" first year will reassure incoming freshman as they become acclimated to college life, thus increasing retention.

# Notes on the Mid-America Christian University Core Curriculum

University Core coursework may be taken in a different sequence with advisor approval but must be completed before matriculating at OSU-CHS. Mid-America Christian University general education requirements are listed on the following table. Some of these courses also fulfil requirements in the Biology Major.

University Core (46 Hours)	General Education Courses
I. Communication (9 Hours)	ENGL 1103, ENGL 1203, and COMM 1103
II. U.S. History and Government (6 Hours)	POLS 1103 and HIST 2103/2203
III. Science (7 Hours)	NATS 1014, NATS 2101 and NATS 2103
IV. Math (3 Hours)	MATH 1513
V. Social Sciences (3 Hours)	PSYC 1103
VI. Humanities (6 Hours)	ENGL xxxx Literature and HIST/GEOG
VII. Bible/Theology (12 Hours)	BINT 1223, THEO 1103, BINT 3733, and BINT 3303

#### **Project Objectives and Plans**

This National Science Foundation (NSF) proposal, Integrating Science, Math and Education (ISME), is an Institutional and Community Transformation (ICT) Level 1 project intended to improve undergraduate understanding of biology, chemistry, mathematics, and education as interdisciplinary subject matter at an institution that has not previously received an NSF award. The ISME project will explore the use of interdisciplinary and interdepartmental activities at Mid-America Christian University (MACU) in Oklahoma, linking the Schools of Mathematics and Science with the School of Teacher Education, and is designed to measurably increase **knowledge and self-efficacy** in math and science among undergraduates in both schools through an innovative community partnership that leverages the evidence-based practice of learning by teaching.

Further, the ISME project emphasizes the involvement of undergraduates from underrepresented groups (URGs) in interdisciplinary math, science, and education activities through a collaboration with Santa Fe South (SFS) Schools, a fully accredited, tuition-free public charter school district consisting of seven schools with 93% Hispanic/Latino students from the Oklahoma City Public School District attendance area serving students from Pre-K through 12th grades. URGs include "women, persons with disabilities, and three racial and ethnic groups – blacks, Hispanics, and Native Americans or Alaska Natives – who are underrepresented in fields [such as] science and engineering" (National Center for Science and Engineering Statistics, 2017).

This project tests the ISME team's theory of change that co-curricular collaboration between undergraduate STEM majors and their preservice teacher peers, which leverages evidence-based models of engaged learning in community-based settings, can measurably increase content knowledge and self-efficacy for both groups of undergraduates, and catalyze a broader transformation of the institution. The theory of change builds on Estrada's research findings that "Co-curricular programs create engaging environments when they introduce activities or context that result in students meaningfully connecting to [Science, Technology, Engineering and Mathematics (STEM)] content...[, which], can be effective in retaining interest and persistence" (Estrada, 2014). Co-curricular activities also increase the success rates of URGs in STEM (Estrada, 2016). Among co-curricular activities studied to date, those emphasizing instructional methodologies—learning through teaching and preparing to teach subject matter—are among the most effective. (citation)

The driving force of ISME will be systematic collaboration between MACU science and math majors and preservice teachers in the context of a partnership between MACU and SFS Schools. ISME will require mixed project teams of science majors, math majors, and preservice teachers to prepare and demonstrate responses to a menu of questions posed by grade 4-6 students at SFS Schools (questions that the MACU project teams and SFS teachers have worked together to prepare). This partnership—to be branded "Ask a STEM Major" for the SFS students—builds on "learning by teaching" pedagogical models whose effectiveness is well-supported in academic literature (citation). "Ask a STEM Major" activities will increase MACU undergraduate
participants' STEM knowledge and self-efficacy and also contribute to the following objectives: (1) incorporate significant interdisciplinary research and peer learning elements that broaden the preservice teachers' experience with scientific methodology and expose the science and math majors to educational theory and practice; (2) increase coordination, collaboration and substantive exchange between MACU faculty in the Schools of Math, Science, and Teacher Education; (3) provide practical assistance to inservice teachers working with a largely underserved student population at SFS Schools; and (4) create mentoring opportunities linking undergraduate STEM majors to elementary school students that have the potential to generate critical long-term interest in STEM. "Since interest in STEM subjects and STEM careers is largely formed by the time children reach the upper elementary and middle school level, it becomes increasingly critical that children's interest in these areas be captured and encouraged during the early to middle elementary grades, long before the point at which they enroll in courses leading to eventual career paths during high school and college" (Daugherty, Cartter & Swagerty, 2014).

The "Ask a STEM Major" activities will be the vehicle for engagement with the SFS students in order to generate this interest, as well as the mechanism for improving STEM content knowledge and self-efficacy among the participating MACU science and math majors and preservice teachers. ISME is structured around the preparation and execution of "Ask a STEM Major," drawing on over fifty years of empirical research supporting the fundamental insight that "teaching produces a more enriching experience than learning for oneself" (Duran, 2016). The learning benefits of teaching were first documented in studies of peer-to-peer tutoring that measured consistent improvement in test scores for student tutors relative to their tutees (Cloward, 1967; Allen, 1976; Kulik & Kuik, 1982). Subsequent experiments confirmed that these cognitive benefits are also present in situations where students are asked to explain what they have learned to classmates and teachers, or even to a remote audience via video recording (Annis, 1983; Ehly, Keith & Bratton, 1987).

Of the different learning arrangements tested, those involving expected or actual teaching—defined as explanation plus substantive interaction and questioning—delivered the greatest quantifiable benefits for the student-teachers. Repeated studies across subjects (science, math, reading) and interpersonal variables (ages of student teachers and learners) have made these findings the scholarly consensus (Roscoe & Chi, 2007). More recent research seeking to differentiate between the effects of teaching expectancy and actual teaching suggests that the latter is more effective in stimulating long-term retention (Fiorella & Mayer, 2013), though the impact may ultimately be dependent on the level of interaction present in the teaching activity (Kobayashi, 2019). The ISME project is designed to reflect each of these components through a dynamic structure centered on interactive student-teaching in real time, coupled with strong elements of peer-to-peer engagement, tutoring, and mentorship that involve all participants (MACU science and math majors, MACU preservice teachers, MACU faculty, SFS teachers and SFS students). A basic operational framework of the project is as follows:

- 1. Led by the PIs, MACU faculty from the Schools of Math, Science, and Teacher Education will convene in a series of seminars to review the ISME objectives and processes and make necessary logistical arrangements for starting the project (including meetings with SFS Schools administrators and teachers). Faculty will meet regularly at the direction of the PIs to discuss project developments.
- 2. Sophomores, juniors, and seniors drawn from MACU's current and future pool of science majors, math majors and preservice teachers who meet the academic criteria outlined in this narrative will be contacted and encouraged to participate in ISME
- 3. MACU faculty will hold an orientation seminar during the first month of the academic year, in which the participating undergraduates will be sorted into mixed STEM major/preserve teacher project teams and introduced to the how ISME works. The faculty and undergraduate project teams will meet regularly (at least monthly) at the direction of the PIs to discuss project development, learn relevant science, math and education material from the faculty, and share other relevant information. ISME faculty will also use these meetings to administer periodic assessments of the participating undergraduates' content knowledge and self-efficacy
- 4. Each undergraduate project team will be assigned an SFS Schools teacher in grades 4-6, and meet with that teacher in person or via teleconference on a monthly basis to discuss the STEM curriculum for that month and develop a "menu" of age-appropriate, research-based STEM questions for SFS students to ask and the MACU teams to "answer" in class. The Next Generation Science Standards (NGSS) "Nature of Science" framework will be followed
- 5. Each undergraduate project team, working with ISME faculty, will prepare a research response to these questions that they can present to the SFS students in their assigned class. The lesson development process will involve structured peer collaboration sessions and engaged group learning with input from the preservice teachers and STEM majors on each team, as well as information exchange and student-teaching simulations between teams. A multimedia requirement will use the popular Desire 2 Learn (D2L) online platform to facilitate communication within ISME and slideshow software as part of the research response presentations
- 6. "Ask a STEM Major" teaching sessions will be held each month at SFS Schools for the MACU undergraduate project teams to take questions from their assigned classrooms and provide answers to the students as dynamic, interactive lesson plans
- 7. SFS students will have the opportunity to pose follow-up questions to the MACU undergraduate teams in monthly video conferencing sessions scheduled after the "Ask a STEM Major" teaching exercise. A monthly timeslot will also be scheduled for the MACU undergraduates to provide individual tutoring in science and mathematics to SFS students from their assigned classrooms who need extra help
- 8. This process will be repeated three times (one for each year of the ISME project period)

The ISME Project will generate data used to measure the anticipated increase in understanding of math and science subject matter as well as self-efficacy for the participating STEM majors and preservice teachers at MACU. According to Margolis (2006), student self-efficacy—defined as the student's belief that they have the capabilities to organize and execute the courses of action required to produce given attainments—is a strong determinant of student persistence, motivation, and achievement. This data will be gathered through periodic assessments of both content knowledge and self-efficacy in both groups of undergraduates. The data gathered should contribute to what is known about the impact of learning-by-teaching and interdisciplinary strategies on undergraduate student learning (particularly for URG students). MACU does not currently offer systematic, interdisciplinary teaching and learning activities for math and science majors of the kind that will be the central focus of the ISME project.

Research across a wide range of settings has demonstrated that the importance of role models in STEM is particularly acute for URG students at every level (citation). To that end, MACU's diverse population can significantly contribute to an increase in STEM interest and persistence among URGs in the local community by creating an engaging environment for these students. MACU's undergraduate student population by gender consists of 63% women and 37% men; of the 1,462 undergraduates, 9% are African-American, 47% are Latino, and 2% are American Indian (NCES, 2018) These peer-to-peer connections, particularly between women and minorities who are underrepresented in the STEM fields, are vital to improving self-efficacy. Students with low self-efficacy are likely to give up easily or avoid academic tasks. Further, STEM education is critical to the future of the U.S. and increasing the number of women and minorities in STEM is a particular challenge.

The ISME project is also intended to assist local teachers, and particularly many emergency certified teachers, at the elementary school level who may lack the confidence to teach STEM related content. This lack of STEM teaching experience among in-service teachers is known to limit their students' experience and interest in STEM learning (Nadelson, Callahan, Pyke, Hay, Dance & Pfister, 2013). Oklahoma's education workforce is facing a particularly dire shortage of qualified teachers generally (**citation**), STEM teachers specifically (**citation**) and qualified STEM teachers in URG communities above all (**citation**). The absence of teachers who are prepared to meaningfully engage students in science and math subjects compounds the problems associated with creating and sustaining student interest in the early grades, which in turn affects the continuing issue of STEM "pipeline development" that threatens the state's long-term economic competitiveness. Through the partnership between MACU and SFS Schools, ISME can have a direct impact on improving STEM teaching in Oklahoma City and demonstrate a scalable model for institutions to adopt across the state.

As described below, the ISME project team will employ strategies that are known to be effective for undergraduate math and science students, with a particular emphasis on those that have proven successful at increasing STEM understanding and self-efficacy of URGs. The following are the Specific Aims and related strategies that will be employed by the ISME project team to advance these strategies, as well as a discussion of the alignment with the project rationale and theory of change:

Specific Aim 1: Integrate interdisciplinary, co-curricular teaching and learning at the undergraduate level. ISME will be a catalyst for the transformation of MACU through the development and implementation of strategies for systematic collaborative learning between the Schools of Mathematics, Science, and Teacher Education. Activities under this aim will include leadership seminars for MACU Math and Science and Teacher Education faculty, followed by seminars for the undergraduate STEM majors and preservice teachers participating in the project. These meetings will serve the logistical functions of the project (e.g. arranging project teams and providing a regular discussion forum for all participants) as well as provide a platform for substantive learning. As an example, MACU's Schools of Mathematics and Science faculty will review the use of K-12 Next Generation Science Standards as developed by the National Science Teachers Association and the National Council of Teachers of Mathematics, and subsequently introduce these Standards to the ISME undergraduate participants as a model for effective interdisciplinary collaboration in the development of K-6 STEM content.

Rationale for Specific Aim 1: MACU's interdisciplinary faculty team overseeing ISME will regularly assess participating math and science undergraduates by administering periodic tests of knowledge and self-efficacy and collecting and interpreting quantitative and qualitative data from ISME activities. Students will be required to record the amount of time that they participate in the project, including project team and faculty team meetings, seminars, site visits to SFS Schools, and the use of technology platforms for developing and sharing instructional content related to the project. MACU faculty will monitor these activities to ensure meaningful conversations and to answer any questions from undergraduate participants. In addition to improving undergraduate students content knowledge and self-efficacy, the goals of the ISME program will be to substantially strengthen the ability of students to conduct critical analyses, develop high-level math and science skills to solve a "real-world" interdisciplinary problem (K-6 content development), and effectively communicate math and science topics to all stakeholders. The program will increase the effectiveness of undergraduates' ability to synthetize and apply subject matter in an interactive context that is consistent with their majors and potential further academic or career discipline.

Specific Aim 2: Increase the knowledge and self-efficacy of undergraduate Mathematics and Science majors and preservice teachers through instruction and collaborative learning. The primary strategy to increase undergraduate knowledge and self-efficacy of math and science subject matter involves the co-curricular, interdisciplinary development and delivery of instructional content in response to a series of research questions posed by elementary school students. MACU undergraduate math and science majors and preservice teachers will work closely together (along with MACU faculty members and SFS teachers) to create and teach this content to elementary school students. In doing so, the participating STEM and education majors will also learn from each-other, deepen their own understanding of the STEM subject matter and build confidence in their abilities as future science professionals and teachers, respectively. As part of these activities, MACU faculty will organize the participating undergraduates into collaborative teams and foster mentor relationships between students and faculty. Although preservice teachers currently enroll in a science methods course, they do not collaborate with scientists outside of the formal classroom. ISME will provide that opportunity.

**Rationale for Specific Aim 2**: ISME will enable MACU's faculty to enhance undergraduate knowledge of the subject matter and self-efficacy among science majors, math majors and preservice teachers through interdisciplinary collaboration, peer-to-peer mentoring and faculty-to-student mentoring. This transformation will be implemented throughout the project period and beyond.

In addition to using co-curricular, interdisciplinary and interdepartmental approaches to teaching and learning throughout the semester, MACU students and faculty will visit SFS Schools in order to meet elementary school teachers and understand their needs for math and science lesson plans. This activity will be coordinated between an ISME Coordinator and the SFS Coordinator as described in a Memorandum of Understanding between MACU and SFS schools and demonstrated by the Letter of Collaboration. Additionally, the D2L learning community platform will serve as a launching point for sharing ideas, needs, and content as it relates to the goals of ISME. A critical element under Specific Aim 2 is to develop a mentoring community for faculty to students and a collaborative learning community from students to their peers.

Specific Aim 3: Increase Science and Math lesson exposure for preservice teachers. The ISME team's primary strategy for increasing the STEM content knowledge and self-efficacy of undergraduate science and mathematics majors and pre-service teachers is the development of co-curricular programming that creates an "engaging environment" (Estrada, 2014)-primarily through the partnership between MACU and SFS Schools and the associated "Ask a Science Major" activities. As part of this strategy, faculty will create mixed STEM/education teams to develop collaborations between MACU's math and science majors and pre-service teachers that will also extend to SFS schools. With faculty guidance, the Math and Science majors will co-develop a STEM inquiry-based lesson that responds to math and science questions posed by elementary school students from within a guided list of questions. These lessons will be digitally recorded and made available to the host SFS school for current teachers and teachers-intraining to use for future classes. Lessons developed by undergraduate students for elementary school students will in part consider Bybee's 5E instructional model (Bybee, 2009), the Next Generation Science Standards (NSTA, 2013) curriculum and STEM curriculum based on Piaget's model of intellectual development (Ojose, 2008).

These activities will serve to enhance partnerships between schools (school systems and the university); expand exposure to inquiry-based science for K-6 students; and support pre-service and in-service elementary education teachers in Math and Science disciplines and especially teachers with emergency certifications within the SFS school system. Potential future activities would evaluate whether ISME increases self-efficacy and knowledge of math and science for in-service teachers; increases interest among URG elementary school students in pursuing STEM studies at higher levels, and creates a model that expands to include family and friends (community transformation) of the K-6 students using Citizen Science (2018).

The project will primarily support SFS Schools' four elementary schools, which are 93% Hispanic/Latino, 3% White, 2% Two or more races, and 1.5% Black, with the remainder of students of Native American, Asian or Pacific Islander descent. ISME will primarily serve 1,429 students and about 130 Elementary School teachers in the SFS K-6 schools annually, the goal of expanding to 7-12 grades in the future. Of the 89 undergraduates in the initial cohort of MACU science majors, math majors and preservice teachers, nearly 30% are Hispanic/Latino, 4.5% are mixed race, 3.4% are Black and 3.4% are American Indian, while X% are female.

**Rationale for Specific Aim 3:** A final objective for this project is to support the improvement of local STEM education at the K-6 level by introducing inquiry-based research to elementary school students. The long-term goal is to help plug the leaky pipeline of students who lose interest in math and science during their K-12 education. ISME will offer SFS in-service elementary school teachers an hourly stipend for up to 20 hours during each half of the elementary school year to coordinate with MACU's ISME project team in the development of "Ask a STEM" major content.

MACU boasts a dedicated team of faculty and staff that focuses on providing the highest-quality student support services, with full backing from MACU's administration as demonstrated by Letters of Commitment, from the institution's academic leadership and president. MACU's faculty will supervise ISME undergraduate teams in the process of developing and delivering STEM instructional content for SFS elementary school. A stipend for these undergraduates will help ensure participation in the program and offset costs for the many low-income students who attend MACU (Piper and Krehbiel, 2015). ISME will also provide an hourly stipend for SFS teachers to coordinate activities in their classrooms.

#### Significance of Project

Ongoing shortages in the regional STEM workforce have placed a premium on increasing the number of Oklahoma students pursuing math and science degrees, and on innovative approaches that have an impact on STEM interest, persistence and capacity at multiple points along the educational pipeline. ISME will demonstrate that co-curricular activities can improve STEM understanding and efficacy for the next generation of STEM professionals and teachers. The project will primarily involve MACU undergraduate students (58% of whom are URGs) and support math and science education for more than 4,000 SFS elementary school students over the three-year project period. ISME may help address the shortage of qualified math and science teachers in Oklahoma City by increasing interest in teaching among the pipeline of STEM-focused undergraduate students who are prepared to fill the regional STEM teaching and workforce shortage.

**Oklahoma Teaching Workforce Gap**: Despite a \$5,000 increase in average annual teacher base pay that was enacted in 2018, the Oklahoma State Board of Education was forced to issue a record high number of emergency certifications for teachers (Oklahoma State School Boards Association [OSSBA] Survey, 2018). OSSBA reports that elementary school science and math positions are among the hardest to fill,

and the State is not producing enough of these teachers to replace those who leave the profession or the State (OSSBA, 2018). The STEM workforce shortage is exacerbated by a State crisis in recruiting teachers, including in the SFS Schools where many teachers have emergency certifications and may lack the background to develop appropriate STEM curriculum. Through ISME, MACU's preservice teachers will also be more qualified as measured by test scores to fill open teaching positions, and have an improved ability to teach math and science.

Oklahoma City STEM Workforce Gap: According to ASTRA's 2018 and Innovation Report Card," nearly Oklahoma **"STEM** 81,000 of the 233,000 new STEM jobs in the 40 fastest-growing fields projected for the [State of Oklahoma] over the next decade (35%) are positions requiring at least some degree of postsecondary competence in biology (primarily health fields), while over 43,000 (19%) are engineering-intensive specialties that require a thorough grounding in postsecondary math" (ASTRA, 2018). The Oklahoma Employment Security Commission reports that "there are not enough workers to meet these demands" (OESC, 2017). Yet, the NSF reports, "The representation of certain groups of people in science and engineering (S&E) education and employment differs from their representation in the U.S. population" (National Science Foundation, 2017), which further limits the ability of employers to fill these jobs. MACU seeks to increase interest and understanding of STEM disciplines to help fill this workforce gap over the next decade by better preparing MACU's Mathematics and Science majors, pre-service teachers, current teachers, and students at SFS schools. The ISME project can help address projected shortages in the highest need, highest-growth fields in Oklahoma, including Geosciences, Mathematics, Computer Science, Environmental Science and Life Science (OESC, 2017).

#### Approach:

ISME is a Level 1 Institutional and Community Transformation project focused on exploring new activities that will provide preliminary data for the research team to assess the effectiveness of interdisciplinary and interdepartmental collaborative learning strategies focused on science and mathematics majors and preservice teachers. This research will be used to assess whether participating in ISME's co-curricular activities promotes knowledge of math and science subject matter for ISME peer collaborators and increases their self-efficacy as Mathematicians, Scientists and Educators.

Twenty math and science majors will initially be selected beginning in the fall of 2020 (and each academic year thereafter) based on a grade point average above 3.0, responses to a questionnaire, and a faculty recommendation. Math majors will have completed Calculus I, while Science Majors will have completed BIO I and II and Chemistry I. These students will receive an hourly stipend for serving as ISME participants, as will ten MACU pre-service teachers to incentivize their participation. A key objective of the ISME program is for science and math majors to learn to work with their pre-service teacher peers. These science and math majors will work with pre-service teachers in MACU's School of Teacher Education under the supervision of faculty. All undergraduates who meet the criteria will be offered the opportunity to participate in

ISME. MACU faculty and an ISME Coordinator will match the teams to SFS teachers, and the PI and Co-PIs will monitor the teams throughout the program.

Both undergraduate math and science majors and preservice teachers will work with the SFS teachers through regular in-person visits and online communication for the duration of the project period. The ISME faculty team will also accompany the undergraduate teams during any SFS visits. In-service teachers will be compensated with an hourly stipend for up to 10 hours per month to coordinate these activities with the ISME project team.

(Fig. 1) ISME PROJECT CONCEPT MAP

The ISME project team's approach is outlined below (Fig. 1)



*Faculty Coordination* – A critical component of ISME is leveraging the development and implementation of "Ask a STEM major" activities to improve communication and cooperation between Mathematics, Science, and Education faculty at MACU. Joint oversight of project activities and undergraduate participants from both schools will require a systematic approach to faculty collaboration that will be developed and implemented by the PI, Dr. Harold Kihega (Biology) and Co-PI's Dr. Carol Fowlkes (Mathematics) and Dr. Deshani Fernando (Chemistry) in coordination with Dr. Vickie Hinkle, Assistant Co-Director of the School of Teacher Education and Director of Student Teaching. Coordination activities will include weekly meetings between

Mathematics and Science Department faculty and bi-weekly meetings with Dr. Hinkle to discuss progress. A part-time ISME Coordinator will be hired by the PI to coordinate these meetings and regular collaboration sessions involving MACU project faculty, the

undergraduate teams and SFS Schools. The Coordinator will collect timesheets from SFS Schools' in-service elementary teachers as they contribute the project.

Recruitment of Mathematics and Science majors – MACU's School of Math and Science is relatively new (the accredited mathematics major began in 2008, and biology began in 2016) but enrollment has grown in recent years, and the University is also working toward accreditation for Chemistry majors in the near future. MACU has 8 mathematics majors and 38 biology majors to form project teams with its 43 preservice teachers. Although, recruitment of female Mathematics majors has lagged with only one current female major, approximately 40% of Mathematics and Biology majors are from URGs. MACU has the ability to increase URG and particularly female and American Indian participation in ISME, as MACU faculty are representative of these groups. Recruitment of sophomores, juniors and seniors from the School of Math and Science into the initial cohort of ISME participants will begin in the summer of 2020 for a project start in the fall semester. The application process will be repeated prior to the beginning of the second program academic year and again before the start of the third project year. Selected students will have the option of continuing each academic year through graduation or serving as mentors to new ISME teams on a volunteer basis. Students with a science or math major will be contacted by the Principal Investigator (PI) and Co-Principal Investigator (Co-PI) upon award notification to assess their interest in becoming a participant. Should a participant leave the program, they will be replaced at the beginning of the next semester, or during the semester if time permits for the project leadership team.

*Recruitment of Preservice Teacher* – As a voluntary program, participation in ISME will not be a required part of preservice elementary education major requirements. However, all 43 Early Childhood and Elementary Education majors will be encouraged to participate, and each student who agrees to participate will be sorted into a project team with math and science majors by the faculty team overseeing ISME. These project teams will be provided with a schedule template so that they can arrange weekly meetings in person or online to discuss strategies for preparing Mathematics and Science lessons. Participants will receive a stipend for their service, and benefit from learning to develop STEM lesson plans. The application process for preservice teachers will parallel the selection of STEM majors, with an inaugural group to be recruited in summer 2020 for the first year of ISME beginning in the fall and continuing for two years thereafter on the same timeframe.

Activity	Lead Person(s)	Year 1	Year 2	Year 3	Year 4
1. Inform MACU STEM and	PI/CoPIs				
Education Faculty of ISME award		Х			
2. Recruit Undergraduate Students	PI/CoPIs	Х	Х	Х	
3. Visit and Review SFS Teacher	PI/CoPIs/Students				
Needs		Х	Х	Х	
5. Develop and ISME Program	Student Teams	Х	Х	Х	Х
6. Monitor ISME for Improvement	PI/CoPIs	Х	Х	Х	Х
7. Evaluation Activities	PI/CoPIs/External				

The following chart provides an implementation timeline for the project:

	Evaluator	Х	X	X	Х
8. Develop to expand ISME to	PI/CoPIs				
other K-6 schools and 7-12 grades				Х	Х

## Assessment and Evaluation:

Rather than emphasizing retention and persistence to degree, which remains above 90% for MACU's Mathematics and Biology majors, the project team has chosen to focus on assessing whether ISME has achieved its objectives based on the following two research questions:

- 1. Does ISME increase the subject matter content knowledge of participating science and math majors and preservice teachers?
- 2. Does ISME increase subject matter self-efficacy for participating science and math majors and preservice teachers?

To assess the first objective, the ISME team will administer pre- and post-tests to evaluate the participating undergraduates' knowledge of science and math content before and after ISME. These tests will incorporate both formative and summative written reports based on real world science topics and learning outcomes related to appropriate subject content, and will be administered to set a grade point to evaluate the student's knowledge while also considering their ability to understand and use the interdisciplinary subject matter. Learning outcomes will be developed by the ISME team after the establishment of SFS teacher's content needs. The written reports will allow the students to explain their knowledge about particular subject matter in different disciplinary perspectives (such as math, chemistry, biology and education). The grading rubric for this assignment will allocate points based on learning outcomes of that activity. At least two to three of these types of assignments will be given during the semester to gauge student. Further, pre- and post-surveys will be administered to participants using a Likert scale.

To assess the second objective, the ISME team will administer the Science Teaching Efficacy Belief Instrument-Preservice (STEBI-B) to the participating preservice teachers. STEBI-B will be used to assess whether "Ask a STEM Major" preparation to teach and teaching increases the self-efficacy of pre-service science and mathematics educators. This instrument will be administered at the end of the Fall 2020 semester prior to the incorporation of ISME methods. STEBI-B was developed in 1990 and has been used in numerous studies concerning teachers' self-efficacy (Menon & Sadler, 2016). Only the preservice teachers will be measured with STEBI-B; the self-efficacy of the science and math majors before and after participation in ISME will be assessed through the Persistence in the Sciences (PITS) survey, as well as interviews to be developed by the ISME faculty working with the External Evaluator.

In addition to the STEBI-B, the project team will administer the Persistence in the Sciences (PITS) survey. The PITS survey is relevant in that it is designed to measure the impact of "Curricular changes that promote undergraduate persistence in [STEM]" (Hanauer et al., 2016). Although MACU's retention in STEM majors is high, PITS

measures in course-based research experiences (CREs). "Psychometric evaluation of the PITS survey suggests a six-factor model involving project ownership–emotion, self-efficacy, scientific community values, science identity, networking, and project ownership–content." In this instance, the objective is to evaluate whether the ISME course design correlates with increases in STEM major self-efficacy and continued persistence in the major.

Since URGs are of particular interest to this program, the ISME faculty team will conduct an analysis of variance by gender for the participating MACU undergraduates (do females increase their knowledge at a different rate than males in STEM using crosscutting techniques?) and will also conduct an analysis of variance by ethnicity (do American Indian, African American, Hispanic students increase knowledge at a different rate?). This data obtained will answer whether there are statistically significant mean differences in undergraduates' interactions by gender or ethnicity.

Dr. Deshani Fernando will prepare and collect the assessment data in coordination with the Co-PI's. The project team has identified an External Evaluator, Dr. Renee Blumstein, who has similarly worked with Oral Roberts University to validate NSF research data. Dr. Blumstein will review research protocols and prepare a final evaluation report to confirm the validity and reliability of the data. She will also give feedback and suggestions to further develop the ISME program.

## Dissemination

The findings of this project will be disseminated in two ways. First, the PIs will work with the External Evaluator and faculty members who participated in project coordination, data collection and oversight of the undergraduate project teams to develop a manuscript that shares the results of ISME with the rest of MACU and the wider Oklahoma City academic community, initially through a presentation at MACU's annual Research Day. The ultimate goal is submission to a peer-reviewed journal e.g. *Journal of Teacher Education, Science Education, American Biology Teacher*, and *Mathematics Teacher*. The second part of dissemination will involve developing and promoting a website specific to the ISME project, which the PIs will maintain and update for the duration of the project period in cooperation with the MACU Information and Technology Department.

## Critical Risks and Challenges

There are limited risks associated with this ICT Level 1 project. However, the following risks and challenges can be mitigated as described below:

Assessment and Evaluation Risks – While, MACU's small size poses a challenge for sample sizes, the ISME project will impact nearly 90 MACU students and over 4,000 SFS School students during the three-year project period. Formative and summative assessment and surveys, as well as the evaluation will focus on whether ISME participants increase their knowledge of STEM content and their self-efficacy in the subject matter either, in the STEM workforce or as STEM teachers.

*Recruitment Risks* – Undergraduate participation in ISME may vary semester to semester. In its first year, the project will seek to identify ten Mathematics and ten Science majors, which is feasible from among the nearly 50 current math and science majors. The program can be scaled to include more student participants if there is great interest. In addition, Pre-service elementary education students may be reluctant to participate if the interdepartmental peer mentoring is not mandatory. This will be mitigated by faculty coordination, by the stipend offered to participants, and by targeting a minimum of 10 pre-service teacher participants from among 43 in the first year as the project is developed. Should a peer collaborator drop out of the program, the PI and Co-PI's will seek to replace the opening during the semester. The opening will be filled at the beginning of the following semester if necessary.

*Faculty Departures* – The PI and Co-PIs are Mathematics and Science Faculty members as well as Chairs of their departments. There is always a possibility that a team member will leave for a variety of reasons. If this occurs, a Co-PI will serve as interim PI, or the PI or Co-PI will temporarily fill the role of a Co-PI who departs until the institution fills these roles.

## ISME Project Team:

The Principal Investigator (PI) for the project, Dr. Harold Kihega, Associate Professor of Biology, and the Co-Principal Investigator (Co-PI), Dr. Carol Fowlkes, Professor of Mathematics, are the respective Chairs of the Schools of Science and Mathematics and thus well-positioned to lead the ISME project. Drs. Kihega and Fowlkes will be responsible for all aspects of project implementation, including faculty coordination with the School of Teacher Education, execution and oversight of interdisciplinary peer learning and mentorship activities, development and execution of the "Ask a STEM Major" Program and SFS Schools coordination; collecting all formative and summative data designed by the PI and Co-PI through tests and STEBI-B; developing and administering surveys to assess the qualitative impact of the program; and reporting all quantitative and qualitative data collected from the ISME project for publication on MACU's website for consideration by faculty peers at other institutions.

Dr. Kihega is a member of the Otoe-Missouria Tribe, which currently has a professional service agreement with MACU to assist tribal members interested in completing their degree. In addition, Dr. Kihega has three years of K-12 teaching experience as a Biology teacher and has taught pre-service teachers Inquiry Based Science curriculum at the University of Oklahoma. His role as PI is particularly important as an underrepresented minority, and as a role model for Native American students. Furthermore, the Tribe has supported his work by investing in critical laboratory supplies at MACU. This includes microscopes for two different lab rooms, anatomical models and dissecting equipment. Dr. Kihega's goal is aligned with the research objectives of this grant, to increase interest within Science and Math disciplines for minority populations in specified school districts in Oklahoma.

The Co-PI for ISME, Dr. Fowlkes, has nine years of K-12 teaching experience as a secondary math teacher. Her passion for math education leads her to strongly encourage

highly qualified math students in her courses to consider teaching careers, and adjuncts are encouraged to promote teaching as well.

Dr. Kihega and Dr. Fowlkes will work with MACU's chemistry faculty member Dr. Deshani Fernando as a Co-PI. Dr. Fernando has an advanced degree in chemistry and brings more than five years' experience teaching the subject at the undergraduate level. She has also worked as a Research Scientist and Graduate Research Assistant, where she trained and mentored several undergraduate and graduate students. In her role as Co-PI, Dr. Fernando will help prepare and collect tests and data and ensure that assessment data is accurately analyzed. The External Evaluator consultant, Dr. Renee Blumstein, will independently review and report project data.

## Intellectual Merit

ISME has the potential to contribute to the existing body of knowledge on STEM teaching and learning through an innovative project structure that incorporates elements of peer/faculty collaboration and student teaching through learning, both of which are subjects of ongoing academic interest. The assessment and evaluation of project outcomes through both objective (content testing) and subjective (STEBI-B, Likert scale) measures designed to gauge the impact of ISME activities on STEM knowledge and self-efficacy in two distinct groups of undergraduates (the science majors, math majors and preservice teachers—all essential to the larger "STEM pipeline") represents a unique approach to studying STEM education with promising avenues for future research and a scalable model that can be applied by other institutions.

## Broader Impact

One of the strengths of MACU and of the ISME project is the diversity of the STEM faculty, with each member of the project team from an underrepresented background themselves---a simple but powerful factor, given the emphasis placed on engaging URG students. The ISME model offers undergraduate students experiences beyond the typical classroom that measurably improve subject matter understanding and self-efficacy in order to foster better academic performance and professional persistence in the long term. Each STEM major and pre-service teacher gains experience in the real-world application of subject matter content development, while SFS Schools students and teachers are regularly provided with new, engaging content at no cost. This project will also significantly improve faculty communications across disciplines (biology, math, chemistry, and education) and help address Oklahoma City's piece of the teacher shortage and "leaky pipeline" national problem represented by low numbers of STEM majors will gain experience in analyzing and applying STEM topics and communicating across disciplines.

## Conclusion:

The ultimate goal of MACU's ISME project is to increase undergraduate student knowledge and self-efficacy in Mathematics and Science through the application of cross-cutting interdisciplinary strategies grounded in sustained collaboration between math, science and elementary education majors and faculty. In leveraging the power of learning through the act of teaching across disciplines, between faculty, among undergraduate peers and with elementary teachers and students in the field, ISME represents a unique local effort to address the STEM shortage in the Oklahoma communities that MACU services (particularly as it relates to URG's). NSF funding for this project has the potential to transform MACU as an institution, the SFS Schools, and the greater Oklahoma City community by firmly establishing these approaches and laying the groundwork for their expansion and future research. Publication of ISME project findings could foster the efforts of other institutions of higher learning to collaborate with their local K-12 schools in developing similar STEM-related programs.

# MID-AMERICA CHRISTIAN University

School of Math and Science 3500 SW 119<sup>th</sup> St Oklahoma City, OK 73170



# Proposal to The Otoe-Missouria Tribe of Oklahoma for a science donation:

Mid-America Christian University is a non-profit liberal arts institution in Oklahoma City, Oklahoma. The university was founded in 1953 as Gulf-Coast Bible College, originally located in Houston, Texas. The college relocated to Oklahoma City in the fall of 1985. We recently celebrated our thirtieth anniversary in Oklahoma City. Upon the move to Oklahoma, the institution changed its name to Mid-America Bible College. The name was changed in 2003 to Mid-America Christian University.

Mid-America Christian University is fully accredited by the Higher Learning Commission of the North Central Association of Colleges and Schools (NCA), having received a ten-year accreditation during its review in 2014. The School of Teacher Education is accredited by the Oklahoma Commission for Teacher Preparation (OCTP). MACU currently offers 2 Associate in Arts degrees, 31 Bachelor of Science and Bachelor of Arts degrees, 5 Masters Degree programs, including areas of concentration for an MBA, Masters of Science in Counseling and the Master of Ministry degree. Course work is offered in traditional, evening (accelerated on-ground) and on-line learning formats. MACU currently has 2,400 students enrolled (July, 2016), and graduated 634 in May of 2016.MACU also compete in the Sooner Athletic Conference of the NAIA, with 9 varsity sports. MACU Men's Basketball won the NAIA national championship this past March.

Dr. Harold Kihega was recently hired at Mid-America Christian University and is currently developing a biological science program to meet the needs of our society by nurturing the development of future students in the areas of science, technology, engineering, and mathematics (STEM). According to the National Math & Science Initiative, the U.S. is lagging behind other countries in the areas of STEM professional education. Our future plans at MACU are to increase the student population's interest in STEM by offering biology courses, which will be transferable to professional health and other post-baccalaureate programs. In the near future, we hope to eventually build a bridge program to Oklahoma State University's Center for Health Sciences "Advancement of American Indians in Medicine and Science" program.

The area of need for our biology department is laboratory equipment, specifically microscopes, which serves as a fundamental foundation for the majority of biology courses offered at the college level (i.e. Biology I & II, Anatomy and Physiology I & II, Zoology, Botany, Human Physiology, Cellular Biology etc.). The impact of your donation will provide decades of use for our department as well as thousands of future leaders graduating from MACU.

The Otoe-Missouria tribe will be monumental in assisting the beginning stages of MACU's STEM curriculum growth. The following is a budget for such a purpose.

Olympus CX23	Binocular Microscope 16 units at \$1699.00 each = \$27,184.00
Optical System	Infinity optical system
Body	Aluminum die-casting metal frame, Protective covering
Illumination System	Built-in transmitted illumination system, LED Power Consumption 0.5 W (nominal values)
Focusing	Stage height movement (coarse movement stroke: 15 mm), coarse adjustment limit stopper, Torque adjustment for coarse adjustment knob, Fine focus knob (minimum adjustment gradations: $2.5 \mu m$ )
Revolving Nosepiece	Fixed quadruple nosepiece
Stage	Wire movement mechanical fixed stage Traveling range: 76 mm (X) x 30 mm (Y), Specimen holder, Specimen position scale
Observation Tube	30° inclined binocular tube Interpupillary distance adjustment range: 48 – 75 mm, Eyepoint adjustment: 370.0 – 432.9 mm
Objectives	Plan achromat, anti-fungus 4x NA: 0.10 W.D.: 27.8 mm 10x NA: 0.25 W.D.: 8.0 mm 40x NA: 0.65 W.D.: 0.6 mm 100xOil NA: 1.25 W.D.: 0.13 mm
Eyepiece (10x)	Field Number (FN): 20 (anti-fungus)

With your generous donation of \$27,184.00 our main biological laboratory will be named "The Otoe-Missouria Biological Laboratory." A bronze plaque will be added to the lab room entrance, which is located in the new Kennedy Hall building. We appreciate your consideration concerning our request and are willing to entertain any assistance from your organization.

Dear Otoe-Missouria Tribal Council,

This is a brief note to you to express our gratitude for your consideration to build a relationship with Mid-American Christian University (MACU). As you are aware very few American Indians (AI) persist through a college program in the area of Science, Technology, Engineering and Mathematics (STEM). This is why we are reaching out to your tribe to build a relationship by giving your students the opportunity to become familiarized with STEM content. Often students enter their high school years without a plan for the future, this is why a STEM camp may become an important experience for your students. One favorable aspect of our camp development is having an Otoe-Missouria (OM) tribal member serving as co-supervisor. Both Dr. Kihega and Dr. Fowlkes will have the student's best interest concerning their academic endeavors during and after the proposed camp.

According to recent studies, graduation rates for AIs are less than half of their counterparts (Bergstrom, 2012). AI graduation rates are the lowest of all minority groups in the U.S. (Hunt & Harrington, 2008). Persistence rates in college for AIs are lower in both the general population and all other minority groups combined (Hoffman, Jackson, & Smith, 2005). Finally, AI freshman are the least represented group interested in STEM (National Science Board, 2012). According to Kihega (2016), successful AI scientists are concerned with the limited exposure to other AI students in STEM, and that they had practically no exposure to AI teachers in STEM throughout their K-20 careers, these are factors contributing to student distress. Furthermore, Kihega (2016) found that interest in STEM content develops as early as 2<sup>nd</sup> grade, and that STEM educators serving as mentors were vital for student persistence.

MACU believes that developing a STEM camp for the OM youth will contribute towards their success and increase their desire to serve the OM community by sharing their experiences with their siblings, extended family members and their peer community. The camp will provide excellent hands-on learning opportunities which has been shown to be a significant predictor of students' value of STEM fields (Fowlkes, 2014). Also, we are excited to allow top students to return to camp the subsequent year to serve as mentors for new camp attendees. In our experiences, this camp mentor component is a new approach that has not been practiced in other STEM camps. This should ultimately foster leadership skills, and build confidence for the mentor. Ultimately, MACU believes this to be an extraordinary opportunity to positively influence both parties involved, but more so for the OM students and their community. We look forward to hearing from you soon. Please feel free to contact us with any questions or concerns.

Best regards,

Halk Harold Kihega, Ph.D.

Carol Fowlkes, Ph.D.



## **PROJECT DESCRIPTION**

## a. Results from Prior NSF Support

Mid-America Christian University faculty has not previously been awarded a National Science Foundation grant.

## b. Project Objectives and Plans

This proposal, Technology for Engaging Environments in Mathematics and Science (TEEMS), explores the use of technology-assisted learning to create "engaging environments" (Kirkwood & Price, 2014; Hu, Hui, Clark & Tam, 2007) as a co-curricular intervention to enhance engagement for academically talented, first-generation, underrepresented groups (URG's) including women, African Americans, Latinos, and American Indians (AI's) with the goal of increasing the numbers of URG's graduating with a biology or mathematics "Co-curricular programs create engaging environments when they major. introduce activities or context that result in students meaningfully connecting to STEM content...[, which], can be effective in retaining interest and persistence.... (Estrada, 2014)." TEEMS will build institutional capacity at Mid-America Christian University (MACU) in Oklahoma City, Oklahoma by implementing evidence-based teaching and learning methods described in this proposal that demonstrate an increase in undergraduate retention and persistence to degree and by increasing the overall number of Mathematics and Biology majors at MACU. Our goal is to recruit at least 60 percent of the proposed TEEMS cohort from academically talented American Indian populations, selected from three demographically diverse school districts including, but not limited to Oklahoma City, Moore and Frontier..

MACU's efforts to increase the number of AI math and biology majors through this project considers Tinto's (2017) article *Reflections on Student Persistence*, which focuses on three important concepts pertaining to overall student success, motivation and retention. 1) Student self-efficacy is vulnerable, especially during the first year of school. 2) Early in their school career, students must have a sense of belonging, especially those of similar socioeconomic backgrounds. 3) Students must value the curriculum, which is especially important in gateway courses that occur early in a student's academic career.

As an additional influence aimed specifically at AIs, Moore's study of AI college level mathematics students in 1994 considered whether "environment, social transmission, and experiences make a difference" in the ability of AI students to perform "Piagetian conservation tasks i.e. substance, weight, displacement, and area." AI students in Moore's research scored lower on these tasks than the general population. Moore concluded that educators must consider how the environment influences student performance. Furthermore, instructional methods become significant when considering STEM content and concepts. Through TEEMS, MACU will consider the environment and cultural needs of its AI students, consistent with Tinto and Moore's findings.

Although the focus of the research will be on the impact of technology-assisted learning as an important influence for providing biology and math students with an engaging environment, the project plan also entails multiple co-curricular supports including: 1) Recruit URG's that are academically talented yet lack opportunities to obtain adequate financial assistance to complete a degree program in a STEM related field; 2) Enhance retention through peer-to-peer mentoring and laboratory support, faculty-to-student mentoring including mandatory online chat sessions with faculty during freshman and sophomore years; 3) Improve STEM related communications across disciplines through small group journal clubs; 4) Expose students to informal learning situations through peer-led study sessions, and mentoring of incoming freshmen; 5) Guide students through the application process of applying for professional graduate schools; and, 6) Encourage students to become independent critical thinkers through both formal and informal small group assignments and research.

This Track 1 Institutional Capacity Building initiative builds on the University of California Biology Scholars Program (BSP) model, which uses an individualized approach to reinforce students' identity as scientists. BSP is proven to increase undergraduate graduation rates and grade point averages (Matsui, Liu, Kane, 2003; Estrada et al. 2016). MACU's student population reflects the types of students served by BSP, which included 80% of BSP members from under-resourced high schools, economically disadvantaged backgrounds, and first-generation students. BSP recognized that individualized plans for student success *may* mean that BSP members take courses, conduct research, and graduate on a "different clock" than their classmates. Considering Tinto (2017), MACU will place particular emphasis by ensuring that students are successful in gateway courses.

TEEMS will mirror the BSP model through the use of co-curricular activities including scholarships, mentoring, tutoring, and research opportunities. However, MACU will also augment this model by focusing efforts on the AI population and the use of technology-assisted learning tools. The BSP model is proven to be successful for African-American and Hispanic students. MACU will assess whether BSP strategies are also effective for AI students. In addition, TEEMS will seek to measure the value of online tools to increase student engagement, including online chat sessions with faculty and peer mentors, videotaped dissections with accompanying test preparation materials, and journal club presentations open to a community audience using technology. As described in the Equipment budget, MACU will also integrate physiology computer simulation programs, an IMB-SPSS statistical program, and a mathematics program called MatLab, and use accompanying materials to assess the impact of these tools on test scores and student grade point averages (GPAs). Technology-assisted learning provides "significantly greater learning effectiveness... than with conventional face-to-face learning. Learning style has noticeable influences on the effectiveness and outcomes of technology-assisted

learning." (Hu et al., 2007) MACU will evaluate whether access to supplemental technology supports the evolution of the BSP model for URG's.

With the understanding that biology and mathematics has a wide variety of specialized topics, the TEEMS students will demonstrate knowledge and understanding of the following core components: Crosscutting concepts that integrate mathematics and science are necessary for developing an integrated, scientifically-based view of the world. Crosscutting concepts include patterns; cause and effect; scale, proportion, and quantity; systems and system models; energy and matter; structure and function; and stability and change (National Science Teachers Association [NSTA], 2014). Further, TEEMS students will be evaluated their Junior and/or Senior Year for the following: Collect and interpret quantitative and qualitative data of various systems utilizing appropriate scientific models and computer simulations; Critically analyze and infer relationships between biotic and abiotic systems based on evidence and experimental repeatability; Apply scientific methodology to develop appropriate research protocol based on well-proven theories, processes, and mathematical functions; Construct applicable analysis and evaluation of current peer-reviewed research literature and integrate alternative research procedures and new ideas; Understand that the field of science is a human endeavor that is tentative, and relies on evidence based explanations; Effectively communicate scientific knowledge through peer, community and scholarly presentations; and, Using well-supported scientific foundations and the understanding of variables, recognize and predict chemical and energy system interactions.

TEEMS will be open to all mathematics and biology majors at MACU. All biology and math majors who join TEEMS will receive generalized support services, consistent with the BSP model, including Learning Communities. Learning Communities... have been found to provide benefits for students and faculty including "higher academic achievement, better retention rates, diminished faculty isolation, and increased curricular integration" (Lenning & Ebbers, 1999). However, only TEEMS participants who receive scholarships will have access to enhanced support services. Services for scholarship recipients will include access to a dedicated computer lab and simulation center, a leading role during journal club and annual Research Day as upperclassmen, and invitations to faculty-led field trips such as to the Oklahoma University History of Science Museum. Journal clubs have been shown to increase student confidence in "accessing, analyzing, and reporting scientific research" and improve students' "confidence and performance in their courses" (Sandefur & Gordy, 2016). Scholarship students will be required to log the amount of time that they use the computer lab and simulation programs, participate in Learning Communities, and attend required and voluntary TEEMS activities. The top performing math and biology majors will attend a national NSF event with a PI.

In order to evaluate these outcomes, students in the biology and mathematics programs at MACU work collaboratively with the faculty and fellow students on a number of key projects as described in Section d. These crosscutting projects are designed to develop the core competencies represented by the above academic learning objectives and data will be collected in and assessed from student records. All students participating in TEEMS will be assessed based on grade point averages (GPA's), test scores, computer simulation program scores, and both formative and summative surveys. In addition, TEEMS scholarship recipients will be required to include additional assessments in their journals.

#### c. Significance of Project and Rationale

One million more jobs in STEM are projected to be created between 2012 and 2022 (Bureau of Labor Statistics, 2014). Yet, the NSF reports that "The representation of certain groups of people in science and engineering (S&E) education and employment differs from their representation in the U.S. population" (National Science Foundation, 2017). The 2010 Census shows 67 percent of the total STEM workforce was non-Hispanic White, but they held 71 percent of STEM jobs. Asians held 15 percent of the STEM jobs compared with 6 percent of all jobs. Blacks held 6 percent of STEM jobs and American Indians and Alaska Natives held 0.4 percent of STEM jobs (Landivar, 2013). Women make up 50.8 percent of the population, but hold only 24% of STEM jobs and make up only about 30% of STEM degree holders (US Department of Commerce, 2017). Regionally, Oklahoma City has a large population of URG's who can contribute to high-need STEM fields, such as engineering, healthcare, aviation, aerospace, supply chain management and management information systems (The Oklahoma State Regents for Higher Education, 2016). MACU reflects a diverse population and can significantly contribute to an increase in URG's choosing a STEM major and persisting to degree, particularly among its population of AI students. MACU's undergraduate student population by gender consists of 59 percent women and 41 percent men. Its population of 2,558 students includes nearly 23% African Americans, 6% Latino and 4% American Indian among other races (Figure 1). TEEMS would enable MACU to increase recruitment of URG students in these fields by providing resources to recruit and educate more students from these populations. With an average student to faculty of ratio of 12:1, MACU dedicates substantial co-curricular support to URG's with limited resources.



*Figure 1:* MACU Undergraduate Race/Ethnicity (National Center for Education Statistics 2017) 2016-2017 Minority Percentages

Financial Need: TEEMS scholarships will be awarded primarily to incoming high school students from Oklahoma City, Moore, and Frontier Oklahoma school districts, with an emphasis on underrepresented minority students and women currently enrolled in a MACU biology or mathematics degree program who meet the Free Application for Financial Assistance (FAFSA) determination of need. The Principal Investigator, Dr. Harold Kihega, Co-Chair of the School of Mathematics and Scienc, is a member of the Otoe-Missouria Tribe, and as a result, MACU has emphasized recruitment of academically talented high school students from Frontier School District where students from several Oklahoma Tribes attend. MACU has entered into a formal Memorandum of Understanding with the Tribe seeking to increase the number of students from the Tribe going into higher education. Based on outreach to the regional school districts, MACU's goal is for 60 percent of its incoming TEEMS scholarship students to be recruited from among students who have self-identified as American Indian. Overall, the TEEMS program has been designed to recruit and retain underrepresented students.

MACU has identified the financial need gap for all its students enrolled in the 2017-2018 academic year as Biology or Math majors in the College of Arts and Sciences (Table 1). The average need gap for all 52 Biology and Mathematics majors is \$7,728, which represents the average amount these students borrow in federal loans to fulfill their financial obligations to the institution.

2017-2018									
Domestic		Nı	umber						
Students		and	% with	Nu	mber and		Numbe	r and %	
Average	# of	dem	nonstrat	Ģ	% with		utili	zing	Average
Cost of	Stu	ed f	inancial	den	nonstrated	Average	Federa	l Loans	Amount
Attendance	den	nee	ed over	fina	ncial need	Financial	to Cov	er Cost	of
\$31,276	ts	\$	$500^{1}$	ov	er \$5000	Need	of Atte	ndance	Loans <sup>3</sup>
College of									
Arts &									
Sciences	52	51	98%	49	94%	\$29,207	32	62%	\$7,728
First									
Generation	29	29	100%	29	100%	\$28,025	19	66%	\$7,593
Under									
Represented									
2	28	27	96%	27	96%	\$27,234	15	54%	\$6,400

Table 1: Financial Aid Need Gap for All Mathematics and Biology Majors at MACU

<sup>1</sup>Average Financial Need = Average Cost of Attendance - Average Estimate Family Contribution. <sup>2</sup>Underrepresented = African American, Hispanic, American Indian, Native Alaskan, Native Pacific Islanders. <sup>3</sup>The average amount of loans includes ONLY those student who took out federal loans. Note: First-generation and Underrepresented are not mutually exclusive categories.

MACU anticipates the following scholarship progression: Table 2: Scholarship Funds Breakdown

Year	No. of Students	Average Scholarship per Students	Total
1	10	\$7,728	\$77,280

2	17	\$7,728	\$131,376
3	17	\$7,728	\$131,376
4	14	\$7,728	\$100,,329
5	5	\$7,728	\$38,640

MACU's School of Mathematics and Science has 20 Math majors and 32 Biology majors. Spring and Fall 2017 semester students had a 100% retention rate for Calculus 1 and Calculus 2. However, among 32 Biology majors in the Fall of 2017, only 20 continued on from Biology I to Biology II in the Spring of 2018. For the purposes of IPEDS reporting and financial aid, 28 of the 52 Math and Biology majors report as URG's with only one female Math major and four of the total math and biology majors who are AI. TEEMS' objectives include increasing the recruitment (see Section f) of mathematics and biology majors, with competitive preference for AI, women, first generation college students, and current underrepresented students in the biology and math degree programs who meet the TEEMS criteria. This aggressive strategy will equip MACU students to help meet the growing demand for STEM employees. MACU has set the following objectives and expected outcomes.

Objectives	Expected Outcome
Recruit TEEMS scholarship recipients as	All Biology and Math majors in TEEM, with
math or biology major over project period.	augmented services for scholarship students.
Increase number URG's as math and biology	Increase number of URG's with preference
majors, with preference for AI's.	for AI's.
Increase gateway course retention from	Retention increased. A greater percentage of
Biology I and II, and Calculus I, II and III	all TEEMS participants will complete
and Chemistry I and II	gateway courses and persist to degree.
Use BSP model to support all TEEMS	Participants will see improved academic
participants (all math and biology majors)	performance, increased retention, and
	increased persistence to degree.
Use Enhanced BSP model, and consider	Participants will see improved self-efficacy,
Tinto and Moore's research to support	academic performance. retention, and
TEEMS scholarship recipients	persistence to degree.

## d. Activities on Which the Current Project Builds

TEEMS will build on the existing biology and mathematics degree program requirements by creating a new residential Learning Community expressly for Math and Biology majors at MACU. The Learning Community will be enhanced for TEEMS participants through peer support and the use of technology-assisted learning, such as online meetings with faculty, peers, and math and biology project simulations. This Learning Community is designed to promote networking, sharing ideas, peer studying, and support system building, and should foster students' success by providing additional opportunities for mathematics and biology students to interact outside of class. Learning Centers have been shown to heighten participants' sense of shared responsibility (Heritage, 2013). Furthermore, the student-to-student learning style that permeates learning communities has been shown to contribute to the success of minority students (Estrada, M., 2016). Student support activities are discussed further in Section g.

Academics: All mathematics and biology majors at MACU submit final projects and research projects and have no minimum wasn't this 2.0? GPA requirements. TEEMS will enhance this experience for URG's by requiring that scholarship students: maintain a GPA of 2.75 or above to keep their scholarships; give a research presentation at MACU Research Day; and, lead a Journal Club session. All students currently receive the following academic and student support services:

**Student Support Center (SSC)** provides Supplemental Learning, Academic and Counseling Support and Assistance, Self-Awareness and Accountability support, and Development services. SSC offers Career Development, a Writing Center, Academic Support & Tutoring, Writing Center support, Academic Support & Tutoring and Career Advising Appointments. TEEMS will augment these services by creating a central support system to address academic and college-life issues to ensure students are performing well academically and adjusting to the demands of college life. A peer-mentoring program will be established to assure success for the candidates and provide sustainability for the program. All incoming freshmen will be assigned an upperclassman student mentor. Upperclassmen in TEEMS will be encouraged to serve as independent peer-to-peer laboratory partners. They must demonstrate a willingness to participate by committing to a minimum of three hours per week to peer mentoring and tutoring and have demonstrated academic success by maintaining an overall 2.75 GPA in Biology and/or Mathematics courses.

Strategies to Achieve Retention: SSC was created to help students overcome the challenges of high school to college transitions. Certain challenges make it difficult for students to complete college degrees, particularly high educational costs, inadequate advising and student support services, and lack of incentives to assist students complete their degree plans (Lumina Foundation, 2001). Low income, first-generation students are more than 40% less likely to complete a four year degree after six years than more advantaged peers (Engle & Tinto, 2008). TEEMS retention strategies that build on current educational activities for Freshman include: Pre-program self-assessment; Attend supervised inperson or online Learning Community; Assigned independent peer-to-peer laboratory partner; and, Complete Mathematics or Physiology Computer Simulations. Sophomores must: Attend supervised in-person or online TEEMS Learning Community; Critical analysis of a peer-reviewed article as described in research by Hoskins et. al., 2006; and, complete computer simulation learning modules; Juniors must: attend seminars with MACU Scholars; be assigned as a mentor for incoming freshmen; join a Learning Community; critical analyses of two peer-reviewed articles; optional internship; contact Professional or Graduate Schools; and, complete computer simulation learning modules. TEEMS Seniors are required to prepare and post a resume at the Student Support Center; become a mentors for Freshman-Juniors; participate in mock interviews; meet with the SSC; lead a journal club session; complete computer

simulations; complete a post-program self-assessment; and, participate in an exit interview with a TEEMS investigator.

**Strategies for Internships, Career and Graduate School Placement**: The MACU Career Readiness Center offers career services to all students. The Dean of the Student Success Center will work in collaboration with the STEM faculty to assist the TEEMS students with career planning. These efforts will include: creating Learning Communities; promoting internship opportunities in their field of study for students who have completed five semesters; evaluating student records to ensure they can clearly demonstrate their knowledge and competencies; planning group attendance at local career fairs; and offering mock interviews tailored to their career of choice. If TEEMS students are interested in entering a graduate program after completing their degree, SSC staff and faculty will help guide them through the application process.

**Community Service**: All MACU students are currently required to perform a minimum number of hours of community service, and this requirement will continue for the TEEMS learning community. TEEMS students may serve as judges at local high school Science Fairs to complete this service commitment.

**Peer Laboratory Partners**: TEEMS students will be assigned peer laboratory partners for independent reviews of their research. All TEEMS students will participate in faculty-led and peer supported computer-assisted learning assignments (measured by hours logged by student).

#### e. S-STEM Project Management Plan

Table 4 provides an overview of the TEEMS project team (Key Personnel). There are two investigators for this project. Principal Investigators (PIs), Dr. Harold Kihega, Biology Faculty, Dr. Carol Fowlkes, Mathematics faculty. Dr. Kihega and Dr. Fowlkes are co-chairs of the School of Mathematics and Science. Throughout the academic year, the PIs will be responsible for all aspects of research including: oversee recruitment strategy; oversee research protocols; obtain student records; prepare research data and analysis; oversee student support services; oversee budget reports; oversee assessment of grant outcomes; review project evaluation; make program adjustments based on student surveys; prepare peer reviewed study; and, disseminate final evaluation report . The AI and female Co-PI's will also serve as role models and mentors, interacting with students in-person at events such as STEM Club and through online meetings with scholarship students. These personal connections separate MACU from other institutions' programs. Annual quantitative and qualitative analyses will be prepared by the Co-PI's during the summer months, as demonstrated in the budget. The above tasks will be performed during the academic year as part of the Co-PI's faculty duties. The PI's will be supported by Ms. Ashley Gotcher, Director of Admissions, and Ms. Susan Michelle 'Mici' Sartin, Chief Financial Office. Morgan Thompson, M.Ed. will serve as Assessment Specialist and an Independent Evaluator will be hired to review and evaluate comprehensive annual program analyses and evaluation reports. TEEMS Coordinator (TC),

Joann Kihega, will be <u>tasked with the following</u>: recruiting and accepting the qualified students (biology and mathematics) into TEEMS; oversee student schedules and manage relationships with SSC services; work with the Office of Financial Aid to ensure financial eligibility; determine amount of scholarship award based on need; oversee academic advising for students; write surveys for faculty and student participants, with PI and Co-PI oversight; analyze and present data for monthly team meetings with PI, Co-PI's and Project Evaluator; organize enrichment activities with PI's; support implementation of the internship program and its placement activities; establish protocols to assess the program's impact; and, prepare reports to meet program requirements. Ms. Kihega has past experience as a URG, and as an AI female chemist, she is a role model for MACU chemistry students. Dr. Fowlkes will oversee the Coordinator position, and the position will be supported as shown below in Table 4.

Individual information files for participants will be maintained and reviewed by the PI's at the end of each semester. The files will include the eligibility data sheet, which will serve as a means for verifying that each participant has maintained a 2.75 GPA, remained enrolled as a math or biology major, and completed all paperwork required by the Financial Aid Office. The file will also include an activities data sheet, which will monitor the student's participation in and evaluation of the various TEEMS activities. These activities include: (1) Learning Communities; (2) Computer Simulations; (3) Seminars with MACU Scholars, (2) Supervised journal club and (3) Seminars with the Career Readiness Center.

Name	Job Title	Reports To	Duties/Requirements
			D di A 1
Harold Kihega, PhD,	Principal	President, Vice-	<b>Duties:</b> Administer the
Professor of Biology,	Investigator	President of	grant and prepare annual
Co-Chair School of		Academic Affairs	reports, budget and
Mathematics and		and Chief	outcome charts
Science		Financial Officer	Requirements: PhD
Carol Fowlkes, PhD,	Co-Principal	President, Vice-	<b>Duties:</b> Administer the
Professor of	Investigator	President of	grant and prepare annual
Mathematics, Co-	Ŭ	Academic Affairs	reports, budget and
Chair School of		and Chief	outcome charts
Math and Science		Financial Officer	Requirements: PhD
Joann Kihega, MS,	TEEMS	Principal	Duties: Oversee student
Adjunct Professor of	Coordinator	Investigators	recruitment, faculty
Chemistry		_	coordination and support
			service navigation.
			Requirements: Masters
Morgan Thompson,	Assessment	Principal	Duties: Oversee student
M.Ed, Dean of	strategies and	Investigators	SSC, scheduling, faculty
Student Success &	assessment reports	-	relations, and support
Accommodations	_		services. Prepares
Director			assessment strategies,
			statistical analyses and
			reports.
			Requirements: Masters

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Social Scientist	Independent	Principal	<b>Duties:</b> Prepare
Independent	Evaluation	Investigators and	independent evaluation
Evaluator		Co-Principal of	of program assessment.
		Investigators	Submit data to PIs
			Requirements: PhD
Mici Sartin, MS,	Budget Director	Principal	Duties: Prepare and
Chief Financial	-	Investigators	manage yearly budget
Officer			and conduct audit to
			assure compliance with
			the NSF and MACU.
			Submit data to PIs.
			<b>Requirements:</b> Masters
Ms. Ashley Gotcher	TEEMS	Principal	<b>Duties:</b> Identify eligible
Director of	Admissions	Investigators	candidates and refer to
Admissions	Coordinator	-	PI/Co-PI.

At the end of each semester, the PIs, Coordinator, Assessment Specialist, and Independent evaluator will meet to evaluate the effectiveness of each TEEMS activity based on review of student files and survey data. The Evaluator will be responsible for documenting the evaluations and action items. The PIs will assign action items to the relevant personnel and monitor the completion of action items to ensure the program undergoes continual improvements. The progression of these improvements through the program model will be measured based on student satisfaction surveys.

Activities,	Responsib	le Party (Tas	k Owner),	Timeline a	are below:
	Year One -	- Schedule o	f TEEMS	Activities	

Timeline	Task	Task Owner
June 2018	Program materials to market TEEMS to regional high schools developed	PI, Co-PI Admissions and Student
July/August 2018	Dissemination of materials to regional high school guidance counselors by Admissions	PI, Co-PI, TC, Admissions, IT and Student Services
August- November 2018	Scholarship material dissemination and recruitment by Admissions at targeted high schools. Presentation by PI at targeted high schools	PI, Co-PI, TC, Admissions, IT and SSC
Spring 2019	Students accepted into TEEMS for fall 2019 receive a guide on requirements for the TEEMS program.	PI, Co-PI, TC
Summer 2019	First cohort of TEEMS students invited to summer orientation. Program eligibility confirmed. Marketing for Year 2 scholars begins.	PI, Co-PI
Fall 2019	First cohort of six TEEMS scholars begins fall 2019 semester. Second cohort recruited for fall 2020.	Pi,Co-PI

Years Two-Four– Schedule of TEEMS Activities

Timeline	Task	Task Owner
September 2020	First cohort begins Year 2 of TEEMS. Second cohort begins Year 1 of TEEMS.	Pi, Co-PI, Admissions
Summer 2021	Third cohort recruited	PI, Co-PI,TC, Admissions
August 2021	Second cohort and Third cohort attend summer	Pi, Co-PI

	orientation. First cohort invited.	Admissions
September	Third cohort students accepted for fall 2021. Cohorts 2	PI, Co-PI, TC
2021	and 3 continue academic years. Fourth cohort recruited.	
August 2022	Fourth and final cohort attends summer orientation	PI, Co-PI
Fall 2022	Final year of TEEMS begins	Pi,Co-PI
Annual	Annual assessments for each program year prepared by PI	PI, Co-PI,
assessments	and Co-PI and reviewed by internal reviewer. Data sent to	internal
Spring 2019-	independent reviewer.	assessment
2022		
Comprehensive	Reviews by Pi, Co-PI, internal and independent evaluator	PI, Co-PI,
assessment and		internal and
evaluation		independent
		assessment

## f. Student Selection Process and Criteria

MACU's plan is to recruit academically talented students primarily from three economically and racially diverse school districts including Oklahoma City, Moore and Frontier OK. Students who meet minimum program requirements will be provided literature on the TEEMS program by their school counselors. They will be invited to participate in TEEMS through regular admission or under a scholarship. TEEMS will employ a number of recruiting strategies. First, the TEEMS PI and Co-PI will strengthen MACU's relationships with identified high schools science and math faculty, and the Director of Admissions will work with high school counselors. Second, TEEMS scholarships will also be awarded to incoming high school students and transfer students based on Free Application for Financial Assistance (FAFSA) determination of need and who have GPA's of 3.0 or greater. Third, TEEMS scholarships will also be granted to current women and underrepresented minorities who are MACU students in biology or mathematics degree programs with a GPA of 2.75 or greater and who meet the FAFSA determination of need.

The Director of Admissions will recommend TEEMS participants and scholarship recipients for the academic year beginning in the Spring of 2019. In order to be eligible to participate in TEEMS, students must meet the following criteria: 1) meet the requirements for acceptance to MACU, 2) have a GPA of 3.0 or higher, 3) qualify for financial aid as determined by FAFSA, and 4) demonstrate strong motivation and community leadership through an essay, 5) have a strong letter of recommendation from a high school science or math instructor. All students who meet these requirements will be invited to interview with a selected committee consisting of the PI, Co-PI, a faculty member outside of the School of Math and Science and a current MACU student prior to participation in TEEMS. However, scholarship preference will go to members of URG's, and particularly American Indian students. Reported racial and ethnic makeup for high school students from area school districts are shown in Table 5 below. Table 5: *Race/Ethnicity for Grades 9 - 12 from Regional High-Need School Districts* 

				Black/	Hawaiian		Two or
School	Hispanic /	Native		African	/ Pacific		More
<b>District</b>	<u>Latino</u>	<u>American</u>	<u>Asian</u>	<u>American</u>	<u>Islander</u>	<u>White</u>	<u>Races</u>

Oklahom a City	51.43%	3.31%	2.50%	25.64%	0.21%	14.43%	2.48%	
Moore	15.31%	5.77%	5.41%	6.84%	0.16%	46.67%	19.83%	
Frontier	12.26%	53.77%	0	0	0	33.96%	0	
(0111		6 1 1						_

(Oklahoma State Department of Education, 2017)

The PIs and Co-PI will examine and evaluate all properly completed applications and determine which students will be invited to join the incoming class. Invited participants will be asked to sign a statement of understanding designed to provide the applicants with understanding that the grant is contingent on the students' completion of the activities designed for the TEEMS students and contingent of their continuous enrollment in MACU's Mathematics or Biology programs. Overall the criteria used to determine participation in the TEEMS, include: 1) student academic record, 2) student essay, 3) student participation commitment; 4) willingness to participate in all of the extra activities designed for TEEMS participants, 5) student GPA, 6) student continuous enrollment in the MACU Mathematics and/or Biology program, 7) student interviews with their counselor. The application process and TEEMS information will be added to the MACU list of financial aid opportunities for potential and existing students seeking scholarship information, including on MACU's website. This information will be forwarded to all of the local high schools in the metropolitan area regarding the TEEMS. Additionally, scholarship information will be forwarded to local and national associations for biology, math and science.

## g. S-STEM STUDENT SUPPORT SERVICES AND PROGRAMS

The MACU Student Success Center (SSC) which offers services to all students, will work in collaboration with School of Mathematics and Science faculty to assist TEEMS students with academic support and career planning, which includes assessing the need for students to pursue advanced degrees in their field. The SSC exists to provide academic support to students, help students develop self-regulating skills, prepare students to market themselves in the global economy, teach students how to think independently, and challenge collaboratively with peers, faculty students to work and private partners. Important aspects of SSC services include: First-Year Evangel to orient students to first year requirements and MACU's issues-based curriculum; Supplemental Learning, which entails intellectual learning that takes place outside of the classroom that complements and improves classroom learning and performance; Support/Assistance by empowering students to complete tasks, set and achieve goals, and make decisions by providing resources, encouragement, and advice; Self-Awareness and Accountability by helping students become aware of personal tendencies and how those tendencies impact their lives through honest accountability; and, Development through the process of holistically challenging students to take ownership of their lives and learning. Critical to the success of TEEMS students include the following services:

**Career Development**: To encourage the application of knowledge learned in the classroom, the SSC provides opportunities for students to prepare for their careers. Services include assistance with resume development and review, interview preparation and mock interviews, career fairs, and assessments. Students looking for jobs, whether part-time while in college or full-time after college, are encouraged to check the SSC Job Boards.

**Writing Center**: Students have the opportunity to meet with a Writing Consultant in the Writing Center for help with any aspect of the writing process, including brainstorming/pre-writing, writing, and proofreading.

Academic Support & Tutoring: The SSC addresses academic and college-life issues. MACU students are advised collectively individually to ensure they are performing well academically and adjusting to the demands of college life. Faculty and peer tutoring and mentoring program assure success. All incoming freshmen are assigned an upperclassman student mentor. Some students may be required to complete an Academic Success Contract as part of their enrollment at MACU. These contracts are overseen by the SSC and include requirements that are designed to help students be successful at MACU. Early warning and custom interventions created by the SSC in collaboration with faculty ensures students have the tutoring, advising, and resources needed to complete needed coursework. Students may be assigned a Time Management Mentor.

**Career Advising**: The SSC seeks to evaluate knowledge and competencies; plan group attendance at local career fairs; facilitate discussions with students to ensure they can apply lessons from their external mentors; and administers a series of mock interviews tailored to their career of choice. If TEEMS students are interested in entering a graduate program after completing their degree, the SSC and STEM faculty will help guide them through the application process.

#### h. Quality Educational Programs

MACU offers quality Biology and Mathematics degree programs and has an established set of high quality student services. MACU holds that there are intelligent, hardworking URG's and first generation college students who would thrive in STEM education and careers with the right combination of quality programs and support services. Over the past five years, MACU has made diversity of its student body a significant priority as demonstrated in Figure 1 with almost 23% African American students, 6 % Latino, and 4% American Indian. Women represent 59% of the student population.

Current mathematics and biology major progressions include: Year 1 and Year 2 – Gateway courses in biology, mathematics and chemistry such as Biology I and II, Calculus I, II and III, Introduction to Statistics, and Chemistry I and II; Year 3 students must demonstrate an understanding of materials from Year 1 and Year 2, and third years students in upper division math courses and/or biology courses must show the above competencies are met including final projects and

research projects; and, **Year 4** students must demonstrate an understanding of upper division math, biology and/or chemistry courses that show competencies met. MACU engages in three distinct processes to ensure the quality of its academic programs. First, each academic program engages in regular assessment of students' performances for the purpose of data-driven quality improvements in curriculum and instruction. Second, MACU assesses each unit or department's strategic plan to ensure each program is setting and achieving aspirations for quality. Third, under MACU's Program Review Policy, all academic programs to undergo a review every three years by an external expert in the field. In addition to the three on campus strategies for quality assurance, these goals are also externally expected and evaluated by the Higher Learning Commission, our accrediting agency.

## i. Generation of Knowledge

The MACU team will use the BSP as a guide to develop a similar model to build institutional capacity for increasing the number of low-income students with an emphasis on AIs, but also considering African American, Latinos, women and current students who participate as biology or mathematics majors at MACU. Mentoring, building community and transitions are key elements of the BSP model (Matsui, 2003). TEEMS emphasizes many of the co-curricular strategies used through BSP, but emphasizes a the use of "engaging environments," which has been identified as an area of research that needs to be explored as a cocurricular intervention. In addition to online support services, the TEEMS project team will deploy biology simulation programs that are intended to teach physiology concepts with simulated lab experiments, as well as IMB-SPSS and MATLAB, which will help students "understand and apply concepts in a wide range of engineering, science, and mathematics applications, including signal processing and communications, control system design, machine learning, computational finance and computational biology." TEEMS will offer students the opportunity to participate in primary research as a co-curricular activity using computer simulations, which will both function to help them meet the learning goals of TEEMS, but will also help them to advance what is known about targeted fields of research such as environmental science. Students will benefit from maintaining journals and sharing through learning communities. Through these teaching and learning tools, the project team will assess and evaluate whether TEEMS increases retention and persistence, and academic success for URG's and particularly AI students.

## j. Assessment And Evaluation

All Math and Biology Majors may participate in TEEMS. However, only a portion of TEEMS participants will be eligible for TEEMS scholarships. The scholarship cohort will be compared to all other TEEMS participants based on GPA, Journal Club and participation in required and optional STEM activities. TEEMS will actively support all biology and mathematics majors, but TEEMS students who receive scholarships will receive enhanced support services. Additional data comparing AI scholarship recipients to all other TEEMS

participants will also be analyzed. TEEMS program will be assessed internally and evaluated independently with direct and indirect measures. Internally, the Biology, Chemistry and Mathematics faculty will measure student performances on the program learning outcomes that will be directly assessed at four checkpoints at the end of each spring. Student performances on TEEMS program outcomes will be measured with 4-point assessment rubrics (1=not met, 2=needs improvement, 3=meets expectations, 4=exceeds expectations). TEEMS faculty will establish intercoder reliability before coding all the student work with the rubrics. The results of the coding will be analyzed to determine whether TEEMS students are meeting the outcomes. In addition, open-end questions will be added to student surveys and coded accordingly. The Outcomes for each of the objectives contained in Section c will be measured for all students who participate in TEEMS versus TEEMS scholarship recipients.

TEEMS has set a goal that 80% of its graduates will meet or exceed the program learning outcomes. If the students fall below meeting or exceeding the program outcomes, the TEEMS Program Evaluator will work with the faculty at the end of each academic year to develop strategies to improve instruction and curriculum to help improve student performances to be implemented the next semester. TEEMS scholarship students will log hours participating in technology-assisted learning and simulation programs outside the classroom. The program team will collect this data and compare it to the control group of non-scholarship TEEMS participants. In particular, the team will assess whether using above or below a certain number of hours on technology-assisted learning impacts GPA's.

The program will be evaluated indirectly as well through the distribution and analysis of student surveys. Prior to the first activity for TEEMS participants, each student will complete an annual "pre-program" self-assessment regarding their self efficacy in both biology and mathematics, their leadership potential (using the online tool available to all MACU students, 5voices.com/), and their sense of community responsibility, along with access of support services. This assessment in order to measure how well TEEMS met its goals for the year. The results will be reviewed and analyzed and modifications to the program will be made if a need is identified from the feedback. Results will be used to improve the academic program and student support services each year. TEEMS graduates will be asked to complete a "post-program" self-assessment regarding their confidence, their leadership potential, and their sense of community responsibility.

## K. Dissemination

The PIs will both benefit from the publication of this research, and will collaborate with the Director of Communications to plan a strategy for sharing the project and accomplishments with the campus and the local, state and national STEM community. TEEMS students will also have the opportunity to share the results of their research at the annual campus research day. Results will be shared with other universities through a TEEMS program link on MACU's website. The MACU site

link will serve as an e-medium for sharing best practices and lessons learned. Articles, presentations, and resources will be posted as well. Finally, some pages within the TEEMS website will be dedicated to the TEEMS students and participants to share their student research and testimonials. Dr. Kihega and Dr. Fowlkes also intend to submit a review of the program to peer reviewed publications including the Chronicle for Higher Education.



# **PROJECT DESCRIPTION**

# National Science Foundation Robert Noyce Teacher Scholarship Program NSF 17-541

## Project Title: "Scholarships for Underrepresented Groups in Education"

Mid-America Christian University (MACU) proposes to contribute to increasing the number of underrepresented groups (URG's) teaching in the STEM fields in Oklahoma by ensuring that this population of women and minority students is able to persist through completion of a teaching degree in a mathematics or science discipline. Data shows that URG's include "women, persons with disabilities, and three racial and ethnic groups – blacks, Hispanics, and American Indians or Alaska Natives – who are underrepresented in fields [such as] science and engineering" (National Center for Science and Engineering Statistics [NCSES], 2017). The project team intends to recruit and prepare twelve science and math teachers within the five-year project period from URG groups. These students will serve the needs of high-need local education agencies (LEA's) including Moore School District, Oklahoma City Public School District, and Frontier Public Schools. This will be accomplished through MACU's "Scholarships for Underrepresented Groups in Education" (SURGE) program to educate future teachers in science and math disciplines, investing MACU's decades-long experience, resources, and personnel to train these teachers. Science and math are shortage areas for teachers throughout the state of Oklahoma. Teachers who graduate from MACU typically serve in the Moore, Oklahoma City, or Frontier School Districts.

The State of Oklahoma has a significant need for a highly-qualified Science, Technology, Engineering, and Mathematics (STEM) workforce. In 2016, over 209,000 jobs in Oklahoma were in STEM fields, and the state projects more than 230,000 STEM-related jobs by 2026, an increase of 10 percent in the next decade (Alliance for Science & Technology Research in America [ASTRA], 2017).) The Oklahoma State Department of Education reports that "STEM jobs are growing and the pipeline is not keeping up. Seventy seven percent (77%) of jobs created between 2010 and 2020 will require post-secondary education. Currently, only 54 percent of the Oklahoma workforce is prepared for these jobs" (Patrick, Neill, and Yunker, 2016).

Although the Oklahoma State Regents for Higher Education reports that "The number of STEM degrees and certificates conferred [at public institutions of higher education] has increased 28 percent over the last five years" (Oklahoma State Regents for Higher Education [OSRHE], 2017, p. 3), there will still be a significant shortfall of workers prepared for these jobs as demonstrated by Oklahoma's 2017 STEM Report Card (ASTRA, 2017). The U.S. Department of Education reports that Oklahoma has had a persistent shortage of math and science teachers since 1990 (Office of Postsecondary Education, 2017).

Further, there is increasing evidence that:



"...the lack of diversity in the science, technology, engineering, and mathematics (STEM) fields imperil[s] business growth and threaten[s] to suppress our nation's competitive edge. Research shows that diversity leads to better decision-making (Levine et al., 2014), more innovation (Hewlett, Marshall, Sherbin, & Gonsalves, 2013), and better outcomes for businesses (Deloitte Australia & Victorian Equal Opportunity and Human Rights Commission, 2013). This is important because the U.S. population is becoming more diverse each year. By 2050, underrepresented minorities (URMs) will represent more than 40 percent of the population, and there will be no majority race" (ASTRA, 2016).

The report from the President's Council of Advisors on Science and Technology [PCAST] (2012) emphasizes the need to produce one million graduates in STEM fields by 2020 to maintain the U.S.'s economic advantage. The 6-year degree-completion rates in STEM majors are less than 40 percent. The challenge of graduating one million STEM graduates by 2020 is even greater since 70 percent of enrolled college students are women and URM's who are more likely to leave their STEM major. Mid-American Christian University (MACU), with a URM population of 41.44 percent and a population of 52.67 percent women, can enroll, maintain and graduate more math and science majors and support their transition into school districts with a substantial shortage of math and science teachers.

## **Emphasis on Mathematics and Biology**

MACU is requesting \$529,749 from the National Science Foundation (NSF) STEM Teacher Scholarship program to implement SURGE, which includes the five-year costs of scholarships, stipends, travel for faculty and students, and the cost of a Project Coordinator/Evaluator. Scholarships will go to juniors and seniors who are secondary math majors, or biology majors who are pursuing alternative education certification, or elementary education majors who are pursuing careers teaching math or science. Priority for awards will go to women and minority students with financial need.

The program will build upon MACU's relationships with the Moore School District, Oklahoma City Public School District, and Frontier School District. SURGE will create a pipeline of URG students interested in science and math fields for MACU to recruit during the latter years of the program. MACU is directly engaged with these school districts, ensuring a collaborative and comprehensive recruitment and retention plan. MACU utilizes its relationships with Oklahoma school districts to facilitate placements of scholarship students and to ensure program participants move to communities most in need of STEM educators. Signed agreements are in place for each of these school districts with MACU describing a mutual commitment to educating and placing teachers in these high-need school districts.


MACU recognizes the need for a strong STEM community and it has situated itself to help meet some of this demand. In particular, MACU offers quality Biology, Secondary Mathematics, and Elementary Education degree programs with a small student-to-faculty ratio to enhance a supportive learning environment that promotes competence and community rather than competition. MACU also has a highly effective team of faculty and staff that focuses on providing the highest quality student support services. MACU believes that there are intelligent and hardworking underrepresented minorities, women, and first generation college students in Oklahoma who would thrive in science and mathematics education programs and careers with the right combination of a quality education and support services that are offered at MACU. MACU currently has three students who will be eligible to be Noyce Scholars. One will be a junior mathematics major, one will be a senior biology major, and one will be a junior elementary education major with a science emphasis for a total of three candidates in the 2018-2019 academic year. The SURGE team will subsequently recruit three juniors in Year 2, Year 3 and Year 4. MACU can recruit and retain a total of 12 Noyce Scholars. The progression of recruitment to graduation and certification as a teacher is presented in the following table:

Academic	Current	New recruits	Graduate	Total Noyce
Year	students			Scholars
2018-19	3		1	3
2019-20		3	2	5
2020-21		3	3	6
2021-22		3	3	6
2022-23			3	3

# **SURGE Project Team**

SURGE entails close coordination between the School of Math and Science and the School of Teacher Education. This coordination will be accomplished by the Principal Investigator (PI), Dr. Harold Kihega, Associate Professor of Biology, and by Dr. Carol Fowlkes, Professor of Mathematics, and Esther Rehbein, Associate Professor and Chair of the School of Teacher Education. Dr. Kihega and Dr. Fowlkes are both Chairs within the School of Math and Science.

Leading the SURGE project as PI is Dr. Harold Kihega, a member of the Otoe-Missouria Tribe. MACU currently has a professional service agreement with the Otoe-Missouria Tribe to provide three years of summer STEM Camp for junior high and high school students. The Otoe-Missouria Tribal Council agrees that there are low numbers of American Indians interested in STEM fields; therefore, they acknowledge the importance of the Otoe-Missouria Tribe/MACU partnership. As reported by the Higher Education Research Institute at the University of



California, Los Angeles, the 2014 administration of the American Freshman: National Norms survey (as cited in National Science Board, 2016), that while the proportion of freshmen that planned to major in a STEM field has steadily risen since 2007, the proportion of American Indians/Alaskan Native freshmen intending to major in a STEM field has declined. Further, American Indians/Alaska Native freshmen are the least represented group nationally. According to Kihega (personal communication, July 16, 2017), there are very few American Indian Science and Math teachers in the U.S. public school system. An Otoe-Missouria female tribal member who earned a degree within a STEM field indicated that she did not have any American Indian teachers in any field during her K-12 education.

In addition to his role in leading the SURGE scholars to degree completion, Harold Kihega has three years of K-12 teaching experience as a Biology teacher and is coordinator of the Otoe-Missouria Tribe Summer STEM Camp ongoing at MACU. Dr. Kihega's role as PI in this project is essential not only because of his academic leadership role, but as an underrepresented minority as a member of the Otoe-Missouria Tribe and role model for Native American students. Furthermore, the Tribe has supported his work by investing in critical laboratory supplies. This includes microscopes for two different lab rooms, anatomical models, and dissecting equipment. Dr. Kihega's goal is to increase enrollment and interest within Science and Math disciplines for minority populations in Oklahoma. This goal is essential in the Oklahoma City region because of the large population of underrepresented groups. The region has a 37.3% minority population including 15.1 percent Black, 17.2 percent Latino, and 3.5 percent Native American population among other races. Women make up 50.8 percent of the regional population (U.S. Census Bureau, 2016).

Dr. Carol Fowlkes has nine years of K-12 teaching experience as a secondary math teacher. Because of her passion for teaching and for math, a strong connection to promote secondary math education is prominent. Highly qualified math students are strongly encouraged to go into secondary math education in the math courses she teaches, and adjuncts are encouraged to promote this shortage area as well. In addition, Dr. Fowlkes received a similar scholarship in her undergraduate program, which encouraged her to go into mathematics education instead of an alternative mathematics field. Esther Rehbein has had 20 years of K-12 teaching experience in elementary education before entering higher education where she continues to recruit and support education endeavors.

MACU's School of Teacher Education trains professional educators who are committed to excellence and, as a result, have a positive impact on student learning. To do so, the department has designed state-approved educational programs that are aligned with rigorous national and state standards. Collaboration between the School of Math and Science and the School of



Teacher Education is constant in advising sessions, performance evaluations, and in evaluating secondary mathematics candidate work, both pedagogically and in content knowledge. Dr. Fowlkes, Chair of the School of Math and Science, is also instrumental to the School of Teacher Education in the creation of rubrics and performance assessments in the content area.

# Academic Requirements Leading to Graduation and Teaching Certification

The curriculum for Mathematics Education majors requires 38 total secondary mathematics hours. These courses include Plane Trigonometry, Calculus I, II, and III (11 hours), Linear Algebra, History of Math, Discrete Math, Introduction to Statistics, College Geometry I and II, Abstract Algebra, and Mathematical Statistics. The degree plan for a Secondary Math major also includes 33 hours of professional education courses. These courses include Educational Foundations, Educational Psychology, Instructional Technologies, Development Across the Life Span, Instructional Strategies I and II, The Exceptional Child, Methods of Teaching Secondary Mathematics, and 9 hours of Student Teaching. The degree plan also includes 46 hours of general education courses required by all students at MACU.

The required curriculum for Biology majors requires 70-71 total biology hours. The Noyce Scholars would be required to take an Alternative Certification route to teach in the State of Oklahoma. They will be required to pass the Oklahoma General Education Test (OGET), and the Oklahoma Subject Area Test (OSAT) in Biology. The state requires one education course initially to receive their alternative teaching certificate and then over the next three years, they must take 18 hours of education courses while they are teaching and must pass the Oklahoma Professional Teaching Examination (OPTE) to receive their full certification to teach Biology.

The required curriculum to complete an elementary education teaching degree requires 48 total hours in subject area courses. These courses include 12 hours of English (English Composition I and II, World Literature I and II), 12 hours of History (National Government, American History, History of World Civilization, Human World Geography), 12 hours of science (General Biology with lab, Environmental Science with lab, Ecology with lab), and 12 hours of mathematics (College Algebra, Math for Teachers I and II, Algebra for Teachers). The course of study also includes 30 hours of professional education courses: Educational Foundations, Educational Psychology, Instructional Technologies, Development Across the Life Span, The Exceptional Child, Instructional Strategies I and II, and 9 hours of student teaching. Elementary Education majors must also take 28 hours of methods courses. These courses include Methods of Reading in Intermediate Grades, Literacy Methods for Early Childhood, Methods of Elementary Science, Methods of Elementary Music/Art, Diagnostic and Prescriptive Reading, Methods of Elementary Language Arts, Methods of Elementary Social Studies, Methods of Elementary Math, Children's



Literature). Noyce Scholars would be required to take Biology for Majors instead of General Biology for the science track and Calculus I instead of Algebra for Teachers for the mathematics track. They must also pass a state test (Middle Level Mathematics/Science Test) to be considered a math/science specialist.

All additional hours to complete any degree are required from the University Core.

By the time a teacher candidate completes a teacher education program, he or she will demonstrate thorough knowledge and performance of the MACU Teacher Education Conceptual Framework, the Unit Standards and Teacher Candidate Competencies, the Oklahoma General Competencies, and the specialized professional standards for his or her respective program.

The alignment of these degree requirements allows the teacher candidate graduate to focus on and accomplish the following MACU Teacher Education Standards and Teacher Candidate Competency Preparing Professional Educators for the Global Vision of the Master Teacher. Formal program reports are also submitted every five years to the Oklahoma Office of Educational Quality and Accountability for program review. Program Coordinators must provide evidence of meeting state competencies based on data from six to eight assessments that show that teacher candidates have mastered the necessary knowledge for the subjects they will teach or the jobs they will perform. In addition, the report must provide evidence that candidates meet state licensure requirements, understand teaching and learning and can plan their teaching or fulfill other professional education responsibilities, apply their knowledge in classrooms and schools, and are effective in promoting student learning and creating environments to support learning. To that end, the program report includes contextual information, assessments and related data, evidence for meeting standards, and the use of assessment results to improve candidate and program performance.

# Internal Collaboration between School of Mathematics and Science and School of Teacher Education

The Chair of the School of Mathematics and Science serves on the Teacher Education Committee and also serves as the Program Coordinator for Secondary Mathematics. The Teacher Education Committee maintains all educator preparation programs and is comprised of representatives of all teacher education programs at the university, community partners such as public school principals and/or teachers, and a teacher candidate. The Teacher Education Committee holds monthly meetings to work collaboratively to create, deliver and evaluate the teacher education programs at MACU. As Program Coordinator of Secondary Mathematics, the Chair annually assesses the Secondary Mathematics program ensuring teacher candidates are



meeting the requirements of the various assessments at program entry, appropriate transition points, and upon program completion.

# **SURGE Program Assessment**

SURGE scholars will be required to maintain a minimum grade point average of 2.8, which is the minimum grade requirements for courses in the major and for professional education courses with the goal of ensuring that SURGE students receive passing scores on the Oklahoma General Education Test (OGET), Oklahoma Subject Area Test (OSAT), and Oklahoma Professional Teacher Examination (OPTE). GPA and test data is currently collected by semester and year and are aggregated and disaggregated for program use and for ensuring the integrity of the School of Teacher Education's process and procedures. Data will be used to meet the goals of the SURGE program. The SURGE program has three goals:

- 1. MACU will recruit and retain URG students to study Math and Science Education.
- 2. MACU will support the URG students through to graduation.
- 3. MACU will provide URG role models in high-need school districts in Oklahoma.

21% of math majors in the 2016-17 school year were in education. To measure the effectiveness of the first goal of the SURGE program, we propose to set the following bemchmarks. In the first year (2018-19), 30% of the math and science majors are also pursuing an education degree and a minimum of 40% per year thereafter.

The second goal deals with persistence to graduation. According to the most recent NC (2016) data, the six-year graduation rate for American Indian or Alaska Native is 67% while Black or African American is 30% and Hispanic/Latino is 50% (National Center for Education Statistics, 2016). To measure the effectiveness of the second goal of the SURGE program, we propose that we track the different URG through to graduation, and achieve a minimum of a 67% graduation rate.

The third goal involves increasing the number of URG faculty role models in science and math at high need schools. MACU oversees an intensive residency program in the first year of teaching of its recent graduates. In addition to six in-person visits each year by the respective MACU project team members, a survey is administered to local school administrators, the MACU project team member, and the first-year teacher. The survey was developed based on Interstate Teacher Assessment and Support Consortium (InTASC) standards that "outline the common principles and foundations of teaching practice that cut across all subject areas and grade levels and that are necessary to improve student achievement" (Council of Chief State School Officers, 2011). By a 360 administration of the survey, interrater reliability is assured. To measure the effectiveness of this third goal, we propose a benchmark of a minimum 75% correlation among



each pair of evaluations: administrator-MACU project member, administrator-teacher, and MACU project member-teacher. By tracking the interrater reliability of these surveys, the SURGE program will demonstrate that URG teachers can be placed in high-need school districts and serve as effective teachers and role models for these students.

# **SURGE Program Recruitment**

In order to recruit Noyce Scholars to MACU, a strong collaboration is required with the local education agencies and the Otoe-Missouria Tribe. The goal is to enhance this collaboration and to become more visible for prospective students. The following recruitment plan has been put into place.

<u>Currently enrolled Mathematics or Science Majors</u>: MACU currently has approximately fifty academically talented Mathematics and Science Majors. Among this cohort, there are two math majors and one science major from low-income households who would benefit tremendously from scholarship support. If awarded the Noyce grant, MACU will reach out to this group in the spring of 2018, and the Year 1 scholarships will begin in the fall of 2018. In addition, the Project Coordinator will be hired to support this group and begin recruitment of new candidates in Year 1 for future scholarships.

**STEM Camp enrollment**: MACU has developed a university community mentorship at a threeday STEM and education camp for students from the regional community. Staff includes firstyear biology and math students as mentors, with faculty supervision. The camp takes place during spring break.

- a. First year STEM students and education pre-service teachers serve as mentors to underrepresented youth during camp (faculty supervision)
- b. Camp progresses into a STEM bridge program for underrepresented groups in STEM fields (communication maintained throughout the camp participant's K-12 career)
- c. Parents and siblings are invited to the last day of camp to increase exposure to underrepresented groups and increase their involvement and interest in STEM fields.
- d. The project team will expand a Summer STEM Camp to increase the pipeline of future Science and Math Majors, and teacher candidates.

Additionally, particular emphasis will be placed on recruiting SURGE Scholars from the pool of Otoe-Missouria STEM Camp attendees. Recruitment will involve the PI, Dr. Kihega, in coordination with the Frontier Public School counselors and Otoe-Missouria Higher Education counselors. The STEM Camp is a three-day event that introduces students to critical thinking, analysis and science research protocol.



**Traditional Recruitment and Enrollment**: In collaboration with the LEA's and the Tribe, representatives from the School of Math and Science, the School of Teacher Education, and from the MACU Admissions office will attend regular recruitment sessions with the LEA's and continue to develop a rapidly expanding relationship with the Otoe-Missouria Tribe. "Lunch and Learns" will be provided to expose students to the need for this shortage area and what the Noyce Scholarship will provide. High school guidance counselors will encourage interested math and science students to attend Lunch and Learns at MACU, which will be offered three times each semester to promote the Math, Science and the elementary and secondary education programs, and to provide information to interested students. Students recruited through this method will be eligible for SURGE their junior year at MACU as STEM majors. The Science Lunch and Learn will be led by the PI, Dr. Harold Kihega. The Math Lunch and Learn will be led by Dr. Fowlkes, and the Teaching Lunch and Learn by Ms. Esther Rehbein. Each Lunch and Learn will also be accompanied by a current MACU student who is majoring in one of these areas. In subsequent years, Noyce Scholars will be the student attendee.

Promotional materials will highlight the strength of MACU's education programs, specifically, the SURGE Noyce Scholarship opportunity. After the Lunch and Learns, prospective students will be contacted within 24 hours via email, phone, or text, followed by monthly contacts. Once application to MACU has been established, the student will be assigned a mentor.

# **External Collaboration Placing Noyce Scholars at the High-Need Schools**

Another strong collaborative effort in the recruiting plan will occur between the LEA guidance counselors and the MACU Admissions team. The PI and Co-PI's will inform school system guidance counselors about the scholarship opportunities at MACU. In addition, the SURGE PI and Co-PI's from the MACU team regularly visit high schools and visit with teacher residents who are MACU graduates. One workshop will also be offered each semester to interested high school students to introduce them to the requirements for completing science and math, as well as to the teaching program. The workshops will utilize MACU's technology such as Smart Board training, Dynamic Geometry Software (Geometer's Sketchpad, etc.), and will allow students with an interest in the sciences to visit MACU's science laboratories. The intent of these efforts is to increase the pipeline of high school seniors who will be eligible by Year 4 of SURGE.

# Intellectual Merit: Data Related to Underrepresented Groups' Recruitment and Retention:

Shortages of both qualified science and mathematics teachers continue to be a widespread problem in our nation today. According to the Office of Postsecondary Education's Teacher Shortage Areas Nationwide Listing, Science has been on the shortage list for Oklahoma every year since 1990. Mathematics has made the list 12 of those years (Office of Postsecondary



Education, 2017). In addition, as the nation's population of students has grown more diverse, the number of minority teachers has become less diverse. "The most recent U.S. Department of Education Schools and Staffing Survey (SASS), a nationally representative survey of teachers and principals, showed that 82 percent of public school teachers identified as white. This figure has hardly changed in more than 15 years; data from a similar survey conducted by the U.S. Department of Education in 2000 found that 84 percent of teachers identified as white (National Center for Education Statistics, 2012). Improving teacher diversity can help all students. [Non-white] teachers are positive role models for all students in breaking down negative stereotypes and preparing students to live and work in a multiracial society. A more diverse teacher workforce can also supplement training in the culturally sensitive teaching practices most effective with today's student populations. (Goldhaber, Theobald, & Tien, 2015)

Not only do science and mathematics teachers need to be recruited, but they need to be retained. There are multiple reasons why women and minority students leave higher education, and particularly the STEM fields. (Chen & Soldner, 2013). Further, there are multiple strategies that are essential to increasing persistence among women and minorities including learning communities, undergraduate research experience, first-year mentoring to help with the transition into first-year academic programs. The SURGE team will seek to increase persistence in first year freshmen intending to major in science and math through collaborative learning and mentorship from STEM faculty. Faculty will develop hands-on discovery learning activities to support incoming freshmen through their transition into their first year of their undergraduate program through induction into a STEM major so they are eligible for the Noyce scholarship their junior year. This includes dedicated lab time or dedicated hours for these students with mathematics faculty. Further, the project team will develop collaborative learning groups within STEM disciplines to increase student retention rates. The goal is to develop and foster mentor relationship between students and faculty. A 2007 research survey of more than 4,000 students found that students who participate in undergraduate research opportunities (UROs) are twice as likely to obtain an advanced degree "as those who did not have pre-college expectations of (Russell, Hancock, McCullough, 2007). Research also indicates that obtaining a Ph.D." mentoring is critical to undergraduate student retention as determined through multiple studies. (Freeman, 1999; Crisp & Cruz, 2009; Pfund, C., 2016).

MACU is increasing this exposure through STEM camps, and through institutional investments in improved laboratories for undergraduates.

**Broader Impact: Creating Opportunities for URG's in the Teaching Profession and Recruiting More STEM Teachers.** 



Recruitment of minorities and women to teach in math and science remains a challenge. Estimates are that 17 percent of all new teachers leave the profession within the first five years of teaching (Gray and Taie, 2015). "[This] problem is especially severe in mathematics and science where content preparation and the availability of well-paying positions in business and industry enable teachers to move into and out of education (Kersaint, Lewis, Potter, & Meisels, 2007). The literature suggests that teachers leave the teaching profession due to inadequate salaries, lack of support from administrators, lack of mentoring, and poor performance on standardized tests (Kersaint et al., 2007). According to Stevenson, Dantley & Holcomb (1999), "...placing heightened emphasis on teacher retention is the most effective means of minimizing the present and future teacher shortages caused by the high attrition of beginning and seasoned teachers."

Addressing equity by creating opportunities for more URG's to enter the teaching profession, especially in the shortage areas of math and science, is an important endeavor. Helping with tuition, providing mentoring and cohort groupings, being involved with service-learning opportunities, and offering professional development opportunities through seminars and conferences are ways to aid in the recruiting process. MACU's approach in this project is to recruit minority students, offering scholarship support as an incentive, and thereby grow the overall number of science and math teacher placements. MCU has a substantial pool of women and minority students to recruit for the SURGE scholarship program as demonstrated below:

Ethnicity	2016	Percent
Caucasian	1301	54.85%
African American	592	24.96%
Native Amer - Alaskan	96	4.05%
Hispanic	165	6.96%
Asian	15	0.63%
International	0	0.00%
Non-Resident Alien	0	0.00%
Pacific Islander	4	.17%
Two or More Races	111	4.68%
DNR	88	3.7%
TOTAL	2372	

# **Total MACU Enrollment by Ethnicity**

## MACU Enrollment by Gender 2016

Percent Men	Percent Women
42.33	52.67





The SURGE program will combine MACU's growing enrollment of women and underrepresented student groups, as shown above, with its strong teacher education programs and STEM training, to recruit, train, and deploy highly qualified STEM teachers into high-needs schools.

# Teacher Shortage Employment Incentive Program (TSEIP) and TEACH Grant

Additional ongoing complementary programs to SURGE include the Teacher Shortage Employment Incentive Program (TSEIP), a legislative ruling administered by the Oklahoma State Regents for Higher Education. TSEIP was designed to recruit and retain mathematics and science teachers in Oklahoma by providing reimbursement for student loan expenses. The amount varies each year, according to state budget allowance. In order to qualify to receive disbursement benefits under TSEIP, the participant must:

- 1. Complete an approved professional teacher education program from an Oklahomaaccredited teacher education unit (must include a student teaching requirement).
- 2. Hold a valid certificate to teach mathematics or science at the secondary level.



- 3. Complete the first full year of eligible full-time teaching service within 25 months from the date of graduation from a four-year institution in Oklahoma.
- 4. Complete course work and training necessary to obtain a teaching certificate, which requires a baccalaureate degree or graduate degree and completion of an approved program of professional teacher preparation. The teacher preparation program shall include a student teaching requirement and authorize service for the secondary level. (Oklahoma State Regents for Higher Education, 2014)

In addition, a Teacher Education Assistance for College and Higher Education or TEACH Grant Program provides grants of up to \$4,000 a year to students who are completing or plan to complete course work needed to begin a career in teaching. As a condition for receiving a TEACH Grant, a student must sign a TEACH Grant Agreement to Serve in which you agree to (among other requirements) teach:

- 1. In a high-need field;
- 2. At an elementary school, secondary school, or educational service agency that serves students from low-income families;
- 3. For at least four complete academic years within eight years after completing (or ceasing enrollment in) the course of study for which you received the grant.

If students do not complete their service obligation, all TEACH Grant funds received will be converted to a Direct Unsubsidized Loan which will be paid to the U.S. Department of Education. To receive a TEACH Grant, the participant must:

- 1. Meet the basic eligibility criteria for the federal student aid programs.
- 2. Complete the Free Application for Federal Student Aid (FAFSA<sup>SM</sup>).
- 3. Be enrolled as an undergraduate, post baccalaureate, or graduate student at a school that participates in the TEACH Grant Program.
- 4. Be enrolled in a TEACH-Grant-eligible program.
- 5. Meet certain academic achievement requirements (generally, scoring above the 75th percentile on one or more portions of a college admissions test or maintaining a cumulative GPA of at least 3.25). For specific information about the academic requirements, talk to the financial aid office at your college or career school.
- 6. Receive TEACH Grant counseling that explains the terms and conditions of the TEACH Grant service obligation. You must complete counseling each year that you receive a TEACH Grant.
- 7. Sign a TEACH Grant Agreement to Serve. (Federal Student Aid, 2017)



33 MACU teacher candidates applied for the TEACH Grant in the 2015-2016 academic school year and two Secondary Math students applied for the TSEIP Scholarship in the 2016-17 academic school year.

All candidates for SURGE will be required to apply for the TSEIP and TEACH incentives annually. The TSEIP and TEACH scholarships will be "stacked" to fill the remaining gap for tuition. In addition, the SURGE team is requesting an additional stipend of \$10,007 per student to offset the costs of room (\$7,439 per academic year), board (\$1,168 per academic year), and books (\$1,400 per year) during each SURGE student's senior year. Currently, MACU students in the College of Arts and Sciences receive an average \$6173.34 in tuition discount. SURGE will cover \$12,000 annually of Noyce Scholar's tuition. Additionally, students will also be required to apply for TSEIP (\$1,500) and TEACH (\$4,000). Student will also be required to complete the FASFA application and take out student loans for any additional gap in their tuition or living expenses. The TSEIP application is sent to the Oklahoma State Regents for Higher Education who track the progress of the candidate to fruition. Each SURGE scholar will also be evaluated on an ongoing basis by the PI and Co-PI's depending on their major, with specific requirements to maintain their scholarship that are similar to TEACH including:

- 1. Teaching math or science at an elementary school, secondary school, or educational service agency where there is a high need for STEM teachers;
- 2. Teach at least two complete academic years for each year of scholarship funds received through SURGE within four years after completing (or ceasing enrollment in) the course of study for which the student received the grant.
- 3. A Competitive Preference Priority will be given to students from the URG population.
- 4. Students already enrolled at MACU will also be required to maintain a GPA of 2.8 before being admitted to the program. All students accepted in the SURGE program will be required to maintain a minimum GPA of 2.8 to continue receiving scholarship funds and to remain in the program.
- 5. Students who do not meet the minimum GPA requirements in any semester will be given one additional semester to raise their GPA to the minimum threshold. If the students are otherwise in good standing, they will be permitted to continue pursuing a traditional degree, but their scholarship will be converted to a traditional student loan.
- 6. Students will be required to sign a SURGE Scholarship Agreement to ensure that students comply with their terms of teaching post graduation and teaching certification in their area of math and science and in a high-need LEA.

SURGE students will be encouraged to participate in the STEM camp program and will receive a stipend for serving as peer mentors and recruiters. Upon graduation, students will go through



MACU's Residency Teacher or Induction program. After attending MACU's Residency Year Program (RYP) training, an assigned university faculty member will meet with a first year teacher a minimum of six times throughout the year. A development plan is created, making sure that the first-year teacher's concerns are addressed and support is provided using the Enhanced Mentoring Model.

During the specified timeframe of the Noyce Teacher Scholarship Program, MACU will research and evaluate other successful Noyce Grant recipients to develop a framework that establishes successful sustainability practices to ensure the continuation of creating teachers in the area of STEM content within the state of Oklahoma. Additionally, the Otoe-Missouria STEM camp model will be assessed and improved upon with the purpose of reaching out to other Oklahoma American Indian tribes to increase STEM interest for underrepresented groups.

# Conclusion

With \$529,749 of funding from NSF's Robert Noyce Teacher Scholarship Program, MACU will establish a collaborative program to train a total of 12 science and math teachers during the fiveyear project period through the SURGE grant and other scholarships. This program, and the teachers it produces, will directly impact the current science and math teacher shortage in the state of Oklahoma. Additionally, the STEM camp model that has been developed with the Otoe-Missioura tribe will be assessed and improved upon with the purpose of reaching out to other Oklahoma American Indian tribes to increase STEM interest that will lead to STEM learning and perhaps careers for underrepresented groups. The program leverages MACU's ongoing partnerships with Moore Public Schools, Oklahoma City Public Schools, and Frontier Public Schools within a comprehensive recruitment and retention plan designed to move highly qualified applicants into science and math teacher education programs at the elementary and secondary education levels in local school districts most in need of strong STEM educators.

2-1-19

The main topics discussed with Dr. Victoria Chraibi, Ph.D. of Tarleton State University, (an affiliate with Texas A&M) are below:

- Summer Internship dates are May 28 August 2, 2019
- Students are housed on campus site
- Students work in the field of a newly "endowed ranch" approximately 850 acres
- Students will study and survey biodiversity
- The study is a pre-post remediation of the 850 acres
- Field conditions are typical of a Texas summer hot and arid
- Plant, Mammal, Freshwater species surveyed while also searching for incidental parasitic interactions
- Emphasis for Sophomore-Senior level Pre-Med or Veterinary Track
- NSF funding for three years, the study is in the second year
- PI Dr. Higgins, Director of the newly developed Field Station
- Grant goal is to support new biology programs that may lack access to undergraduate research

Dr. Chraibi was enthusiastic about developing a relationship between MACU and Tarleton State University. She will be meeting with her PI to discuss future endeavors with MACU.

Sincerely,

Harold Kihega, Ph.D.



OFFICE OF UNIVERSITY MARKETING

Whitney Knight Marketing Specialist - Writer Email: whitney knight@macu.edu P: 405-703-8211 C: 405-213-6690

FOR IMMEDIATE RELEASE: July 16, 2020

## MID-AMERICA CHRISTIAN UNIVERSITY ANNOUNCES PARTNERSHIP WITH OKLAHOMA CITY UNIVERSITY TO PROVIDE PATH TO NURSING DEGREE

**OKLAHOMA CITY** — Mid-America Christian University has partnered with Oklahoma City University to provide MACU students with an avenue to earn a Bachelor of Science in Nursing (BSN) from OCU's Kramer School of Nursing.

The articulation agreement between the two universities will allow students to complete their general education and major science courses at MACU and then seamlessly transfer to OCU to enter the nursing program.

"Healthcare services continues to be an expanding profession, nursing especially," said Dr. David Rose, Assistant Vice President of Enrollment at MACU. "Specifically as we look to the post-COVID environment, there will be a continued increasing demand for registered nurses."

Nursing has been one of the most frequently requested majors from prospective MACU students. To meet that need, Rose said senior leadership set out to develop the articulation agreement with OCU and was met with an overwhelmingly positive response.



"Enrolled students will fulfill their general education requirements, electives and science courses at MACU, then will matriculate to OCU to finish their final 56 hours of nursing courses at OCU."

The articulation agreement is effective immediately, meaning that students who have fulfilled their course requirements at MACU may begin the process to transfer to OCU for their nursing degree.

"Kramer School of Nursing is thrilled to enter into this partnership with MACU to provide baccalaureate nursing education of the highest quality to prepare the next generation of nurses and servant leaders," said Dr. Lois Salmeron, Dean of OCU's Kramer School of Nursing.

A signing ceremony between MACU President Dr. John Fozard and OCU President Martha Burger was held on the MACU campus this morning.

For more information about the new partnership, please visit <u>www.macu.edu/nursing</u>.

**ABOUT MACU** — Mid-America Christian University offers more than a hundred degree and certificate programs covering many specific fields. MACU is dedicated to offering a quality, affordable Christian education to traditional high school seniors, college transfers and busy adults who are looking to finish their education, pursue graduate work or get a college degree for the first time. MACU is an endorsed agency of the Church of God (Anderson, Ind.) and is regionally accredited by the Higher Learning Commission. Visit <u>www.macu.edu</u> for more information.

Biology, Program Review, Section 15

**Curriculum Reviews** 

Course Number	Course Name	*Last Date of	**Planned Revision
		Revision	
BIOL 1013	Medical Terminology	FA 2020	Pending
BIOL 1133	General Nutrition	SP 2020	Pending
BIOL 1214	Biology I	FA 2019	Pending
BIOL 1314	Biology II	SP 2019	Pending
BIOL 2114	General Zoology	FA 2020	Pending
BIOL 2214	General Botany	SP 2020	Pending
BIOL 2314	Anatomy & Phys I	FA 2018	Pending
BIOL 2324	Anatomy & Phys II	SP 2019	Pending
BIOL 3114	Human Anatomy	FA 2020	Pending
BIOL 3214	Human Physiology	SP 2020	Pending
BIOL 3333	Cell Biology	SP 2020	Pending
BIOL 3354	Genetics	SU 2020	Pending
BIOL 3363	Evolution	SP 2020	Pending
BIOL 3404	Ecology	Pending	Pending
BIOL 4124	Histology	SP 2019	Pending
BIOL 4144	Plant Taxonomy	SP 2019	Pending
BIOL 4213	History of Science	SP 2019	Pending
BIOL 4314	Embryology	FA 2020	Pending
BIOL 4501	Biology Research	FA 2020	Pending
BIOL 4901	Special Topics in Bio	SP 2020	Pending
CHEM 1105	General Chem I	FA 2020	Pending
CHEM 1205	General Chem II	FA 2020	Pending
CHEM 3103	Organic Chem I	FA 2020	Pending
CHEM 3102	Organic Chem I Lab	FA 2020	Pending
CHEM 3202	Organic Chem II	SP 2019	Pending
CHEM 3202	Organic Chem II Lab	Pending	Pending
CHEM 3123	Principles of Biochem	SP 2019	Pending

**Curriculum Reviews** 

\*The biology courses were developed and are under constant revisions due to the nature of science. Small changes are made in the curriculum continuously, but the State of Oklahoma Course Equivalency Program dictates the syllabi course objects align with other universities.

\*\*Due to the recent development of the biology program, revisions occur continuously throughout the semester the courses are offered.

Biology, Program Review, Section 16

University Senate Documents Related to Program

## BIOL 1xx3 Medical Terminology

Medical terminology is designed to introduce students to scientific terms by studying root words, prefixes, and suffixes used in scientific professions. Content emphasizes terms used in the health-sciences field to describe anatomy, physiology, pathology, and other comprehensive medical conditions.

## BIOL 4xx1 Special Topics in Biology

This course is designed to further enhance knowledge on certain topics within a specialized area. It is intended for students who want to progress their expertise beyond the regular course curriculum during their junior or senior year. Prerequisite - Instructor approval and upper-division coursework within the math or biological science curriculum. Students may enroll in this course up to a maximum of 3 semesters.

## BIOL 4xx4 Embryology

This course is designed for students preparing for a health-professions graduate program or medical school. It is a systematic study of organismal development with an emphasis in subphylum Vertebrata. The concepts covered include meiosis I and II, fertilization, cleavage patterns, gastrulation, morphogenesis, organogenesis, and developmental physiology. Laboratory is a required and integral component introducing students to anatomical comparisons and analytical evaluation. Prerequisite – C or better in BIOL 3334, or instructor approval.

# CHEM 2xx5 Organic Chemistry II

Organic Chemistry II is a continuation of CHEM 2105. It is a systematic study of various organic molecules, advanced stereochemistry, chemical reactivity, organic reaction mechanisms, and methods for organic molecule synthesis. Laboratory is a required and integral component to learning scientific experimentation safety protocol, measurements, synthesis, purification, and separation techniques. Prerequisite – C or better in CHEM 2105, or instructor approval.

## CHEM 3xx4 Principles of Biochemistry

Biochemistry is a course designed for students preparing for a health-professions graduate program or medical school. It is a systematic study of biologically important compounds with an emphasis in thermodynamics, bioenergetics, metabolic pathways, cell regulatory processes, and enzyme activities. Prerequisite – C or better in CHEM 2105, CHEM 2xx5, or instructor approval.

#### Do not change form wording

#### **PURPOSE: Request for Approval of Curriculum Revisions**

#### Curriculum proposal for: School of Science

Submitted by: Harold Kihega, Ph.D. and Deshani Fernando, Ph.D. School of Science Date: 10/10/19

Process to request approval to revise an existing degree program/concentration/emphasis:

- Fill out the attached Faculty/Senate Proposal form. *Note: this form is <u>not for use to change an existing program into a new degree or emphasis. (approval to develop is <u>not required for any items on this list)</u>*</u>
- Submit your completed proposal and required documentation to the persons listed below for signatures. You may email your proposal to reviewers and attach the email responses to this form keep in mind the required approval order.
- Proposals with all required signatures should be submitted for inclusion on the agenda a minimum of 5 days prior to the scheduled meeting.
- Submit your proposal and all supporting documents to the Dean in one electronic Word file. No PDF documents.

Curriculum components Requested change for:	What is needed (show changes in strikeout and highlights format, e.g., old and new format) Use the MACU Catalog for information and format examples
Admission requirements	
Course description	
Degree Program name	Submit your completed proposal form showing all revised or new information.
Program description	
Program outcomes	
Course (information	Submit your completed proposal form and revised degree evaluation form (if applicable) (A course
changes)	change includes changes in name, department, prefix, number, level, pre-requisites, and credit hours)
Course (new)	Submit proposal form with course name, prefix, and course description and (CAS) semester rotation
	and/or (CAGS) length of course use catalog format) and revised degree evaluation form (if applicable)
Degree evaluation form	Submit your completed proposal form and revised degree evaluation form (the University Registrar or
(degree sheet)	VPAA Office will assist with these changes)

#### Required Signatures

1. Obtain all signatures IN THE ORDER LISTED for purpose of appropriate collaboration, communication and approval.

- 2. The signature form must always accompany your proposal. You can expect revisions at all levels of review.
- 3. Changes requested at any level below should be made before you receive that reviewer's signature.
- 4. Submit your proposal to be listed on the next Faculty Meeting agenda: Upon receipt of notification of approval of your proposal from the VPAA Office - submit an electronic copy of your proposal to the Dean's Administrative Assistant.

Approved: School Chair/Program Director	Date	Comments
Approved: College Dean	Date	Comments
Approved: Vice President for CAGS (CAGS Only)	Date	Comments
Reviewed: University Registrar	Date	Comments
Reviewed: Chief Financial Officer	Date	Comments
Reviewed: Director of Institutional Effectiveness	Date	Comments
Approved: Vice President for Academic Affairs	Date	Comments

|--|

**Proposal to Change -** explain revisions and actions being requested (show changes in strikeout and highlights, e.g., old and new format)

The School of Science determined that two courses did not require a lab for student prerequisites into professional graduate degree programs. Changes are as follows:

- Omit the lab portion from course BIOL 3334 Cell Biology. The suggested new course number will be evaluated and will end in the number 3, example: BIOL 3333
- Omit the lab portion from course CHEM 3104 Principles of Biochemistry. The suggested new course number will be evaluated and will end in the number 3, example: CHEM 3XX3

The School of Science determined that other 4-year universities offer Organic Chemistry courses at the 3000 level. Changes are as follows:

- Change CHEM 2103-Organic Chemistry I to 3103 Organic Chemistry I
- Change CHEM 2102 Organic Chemistry Lab to 3102 Organic Chemistry I Lab
- Change CHEM 2203 Organic Chemistry II to 3203 Organic Chemistry II
- Create CHEM 3202 Organic Chemistry II Lab

Rationale (information supporting proposal – why you are making changes)

Considering the needs of the Mid-America Christian University students enrolled in the School of Science (Biology Program) it was decided to delete the lab portion for two upper-division courses. The courses concerned are currently being developed and have not been taught, therefore no students will have to alter their course load or curriculum hours. After discussions with other 4-year universities and considering the prerequisites to enter into professional graduate schools such as physical therapy, medical school, etc. the lab sections for these courses were not a requirement. This will also cut down on the cost to maintain lab equipment, and the ordering of new lab equipment.

Other information (show new courses, course description changes, etc.)

New Course Descriptions: (omit required laboratory)

**BIOL 3333 Cell Biology (3 cr.)** Cell biology is a course for biology majors considering health-related professional graduate school. It is a comprehensive study of prokaryotic and eukaryotic cells with a comparison in metabolism, energetics, and autogenous regulation, with an emphasis in biochemistry and cellular changes during the life cycle of cells. **Prerequisite**: C or better in BIOL 1214 Biology I, BIOL 1314 Biology II, CHEM 1105 Chemistry I, CHEM 1205 Chemistry II, or instructor approval.

**CHEM 3103 Principles of Biochemistry (3 cr.)** Biochemistry is a course designed for students preparing for graduate school or medical school. It is a systematic study of biologically important compounds with an emphasis in thermodynamics, bioenergetics, metabolic pathways, cell regulatory processes, and enzyme activities. **Prerequisite**: C or better in CHEM 2103, CHEM 2203, or instructor approval.

#### Correlation to the Assessment System & Program Improvement

The new courses will be correlated to the assessment system to assure program improvement. Data informed decisions will be made based on assessment results to continually improve the biology program.

Budget and Correlation to Strategic Planning (include additional adjunct or any other expected costs)

The revisions of the current courses will not affect the budget. The altered courses will be taught by a full-time faculty member or part-time instructor.

Other (Attach all pertinent degree program evaluation forms showing revisions with strikeout and highlights, e.g., old and new format)

See attached revised program sheet.

SUBMITTED BY:	Dr. Harold Kihega and Dr. Deshani Fernando
• Name/Title	CAS/ School of Science
• College/School	Esther Rehbein, Dean of CAS
Proposed Effective Date:	October 2019

#### Do not change form wording

## PURPOSE: Request for Approval of Curriculum Revisions

# Curriculum proposal for: School of Science

Submitted by: Harold Kihega, Ph.D. and Deshani Fernando, Ph.D. School of Science Date: 10/10/19 Process to request approval to revise an existing degree program/concentration/emphasis:

- Fill out the attached Faculty/Senate Proposal form. Note: this form is <u>not</u> for use to change an existing program into a new degree or emphasis. (approval to develop is <u>not</u> required for any items on this list)
- Submit your completed proposal and required documentation to the persons listed below for signatures. You may email your proposal to reviewers and attach the email responses to this form keep in mind the required approval order.
- Proposals with all required signatures should be submitted for inclusion on the agenda a <u>minimum of 5 days prior to the scheduled</u> meeting.
- Submit your proposal and all supporting documents to the Dean in one electronic Word file. No PDF documents.

Curriculum components Requested change for:	What is needed (show changes in strikeout and highlights format, e.g., old and new format) Use the MACU Catalog for information and format examples
Admission requirements Course description Degree Program name Program description Program outcomes	Submit your completed proposal form showing all revised or new information.
Course (information changes)	Submit your completed proposal form and revised degree evaluation form <i>(if applicable)</i> (A course change includes changes in name, department, prefix, number, level, pre-requisites, and credit hours)
Course (new)	Submit proposal form with course name, prefix, and course description and (CAS) semester rotation and/or (CAGS) length of course use catalog format) and revised degree evaluation form <i>(if applicable)</i>
Degree evaluation form (degree sheet)	Submit your completed proposal form and revised degree evaluation form (the University Registrar or VPAA Office will assist with these changes)

#### **Required Signatures**

- 1. Obtain all signatures IN THE ORDER LISTED for purpose of appropriate collaboration, communication and approval.
- 2. The signature form must always accompany your proposal. You can expect revisions at all levels of review.
- 3. Changes requested at any level below should be made before you receive that reviewer's signature.
- Submit your proposal to be listed on the next Faculty Meeting agenda: Upon receipt of notification of approval of your proposal from the VPAA Office - submit an electronic copy of your proposal to the Dean's Administrative Assistant.

Haine Kik	10/23/19		
Approved: School Chair/Program Director	Dáte	Comments	
Approved: College Dean	<u>10-24-19</u> Date	Comments	
Approved. Conege Dean			
Approved Vice President for CAGS (CAGS	Only) Date	Comments	
Reviewed: University Registrar	1824-19 Date	Comments	
Reviewed: Chief Financial Officer	<u>10-28-19</u> Date	Comments	
Reviewed Director of Institutional Effectiver	10.28.19 Date	Comments	
Hanen Mase	10. 24.19	-	
Approved: Vice President for Academic At	fairs Date	Comments	

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Faculty/Senate Checklist – <u>CHANGES</u> (New or Revised Courses/Curriculum Components)

#### Proposal Request to Make Changes to Existing Curriculum or for new courses: (state primary area of change - name of revised degree, new

or revised course, etc.)

Proposal to Change: Revise the Biology Degree Program by omitting the lab section for two courses, BIOL 3334 Cell Biology and CHEM 3104 Principles of Biochemistry, within the School of Science. In addition, change the course numbers for Organic Chemistry I and Organic Chemistry II, modify Organic I lab, and create course for Organic II lab.

Proposal to Change - explain revisions and actions being requested (show changes in strikeout and highlights, e.g., old and new format)

The School of Science determined that two courses did not require a lab for student prerequisites into professional graduate degree programs. Changes are as follows:

- Omit the lab portion from course BIOL 3334 Cell Biology. The suggested new course number will be evaluated and will end in the number 3, example: BIOL 3333
- Omit the lab portion from course CHEM 3104 Principles of Biochemistry. The suggested new course number will be evaluated and will end in the number 3, example: CHEM 3XX3

The School of Science determined that other 4-year universities offer Organic Chemistry courses at the 3000 level. Changes are as follows:

- Change CHEM 2103-Organic Chemistry I to 3103 Organic Chemistry I
- Change CHEM 2102 Organic Chemistry Lab to 3102 Organic Chemistry I Lab
- Change CHEM 2203 Organic Chemistry II to 3203 Organic Chemistry II
- Create CHEM 3202 Organic Chemistry II Lab

Rationale (information supporting proposal - why you are making changes)

Considering the needs of the Mid-America Christian University students enrolled in the School of Science (Biology Program) it was decided to delete the lab portion for two upper-division courses. The courses concerned are currently being developed and have not been taught, therefore no students will have to alter their course load or curriculum hours. After discussions with other 4-year universities and considering the prerequisites to enter into professional graduate schools such as physical therapy, medical school, etc. the lab sections for these courses were not a requirement. This will also cut down on the cost to maintain lab equipment, and the ordering of new lab equipment.

Other information (show new courses, course description changes, etc.)

New Course Descriptions: (omit required laboratory)

BIOL 3333 Cell Biology (3 cr.) Cell biology is a course for biology majors considering health-related professional graduate school. It is a comprehensive study of prokaryotic and eukaryotic cells with a comparison in metabolism, energetics, and autogenous regulation, with an emphasis in biochemistry and cellular changes during the life cycle of cells. Prerequisite: C or better in BIOL 1214 Biology I, BIOL 1314 Biology II, CHEM 1105 Chemistry I, CHEM 1205 Chemistry II, or instructor approval.

CHEM 3103 Principles of Biochemistry (3 cr.) Biochemistry is a course designed for students preparing for graduate school or medical school. It is a systematic study of biologically important compounds with an emphasis in thermodynamics, bioenergetics, metabolic pathways, cell regulatory processes, and enzyme activities. Prerequisite: C or better in CHEM 2103, CHEM 2203, or instructor approval.

#### Correlation to the Assessment System & Program Improvement

The new courses will be correlated to the assessment system to assure program improvement. Data informed decisions will be made based on assessment results to continually improve the biology program.

Budget and Correlation to Strategic Planning (include additional adjunct or any other expected costs)

The revisions of the current courses will not affect the budget. The altered courses will be taught by a full-time faculty member or part-time instructor.

Other (Attach all pertinent degree program evaluation forms showing revisions with strikeout and highlights, e.g., old and new format)

See attached revised program sheet.

SUBMITTED BY:	Dr. Harold Kihega and Dr. Deshani Fernando
• Name/Title	CAS/ School of Science
• College/School	Esther Rehbein, Dean of CAS
Proposed Effective Date:	October 2019

#### Biology, B.S. Effective: 1-1-2019

The biology program at MACU provides students with a strong foundation to enter multiple science careers; STEM graduate schools and professional health science programs. In addition to classroom and laboratory teaching modules, MACU provides abundant opportunities for faculty-to-student mentorships, peerto-peer collaborative learning, and critical thinking opportunities related to science research protocol.

**University Core** 

s: \* \*

Specific courses within the University Core are listed on the first page of this catalog section. University Core (46 Hrs) Bible/Theology (12 hrs) Communication (9 hrs) U.S. History and Government (6 hrs) Science (7 hrs) \*NATS 2101 Environmental Science Lab \*NATS 2103 Environmental Science Math (3 hrs) \*MATH 1513 College Algebra Social Sciences (3 hrs) \*PSYC 1103 Intro to Psychology Humanities (6 hrs – 3 must be literature)

\*These courses are required pre-requisites for the major. Upon completion of the above courses, corresponding University Core requirements will be satisfied. (These courses are required for this major regardless of previous degrees conferred). See the Academic Program Requirements section of this Catalog for additional requirements.

**Orientation (1 hr)** UNIV 1121 First Year Evangel

**Major Requirements** Biology Major (70-72 hrs) **Biology Major Core** (30-31 hrs) Biology I BIOL 1214 **Biology** II BIOL 1314 General Zoology BIOL 2114 BIOL 2214 General Botany BIOL 2314 Anatomy and Physiology I and BIOL 2324 Anatomy and Physiology II or BIOL 3114 Human Anatomy\*\* and BIOL 3214 Human Physiology\*\* BIOL 3305 Microbiology\*\* **Biology Research** BIOL 4501

#### **Biology Major Electives (14-15 hrs)**

Choose 14-15 hours of biology electives from this list. BIOL 1013 Medical Terminology\*\* BIOL 3334-3333 Cell Biology BIOL 3354 Genetics BIOL 3363 Evolution BIOL 3404 Ecology Histology BIOL 4124 Plant Taxonomy BIOL 4144 History of Science BIOL 4213 Embryology\*\* BIOL 4314 Special Topics in Biology\*\* BIOL 4901 CHEM 3203 Organic Chemistry II\*\* CHEM 3202 Organic Chemistry II Lab\*\* CHEM 3104 3XX3 Principles of Biochemistry\*\*

#### Additional Biology Major Requirements (26 hrs)

CHEM 1105 Chemistry I CHEM 1205 Chemistry II CHEM 3103 Organic Chemistry I CHEM 3102 Organic Chemistry I Laboratory MATH 2114 Calculus 1 <u>or</u> MATH 4113 Mathematical Modeling\*\* MATH 3703 Introduction to Statistics PHYS 1134 General Physics I (w/ Lab) <u>or</u> PHYS 2104 Physics 1

#### General Electives\*\* (6 Hrs)

Choose 6 hours of electives from this list.
BIOL 1133 General Nutrition
PHYS 1234 General Physics II
PSYC 3813 Cognitive Psychology
PSYC 4213 Physiological Psychology and Neuroscience
PSYC 4703 Psychology of Abnormal Behavior

Students must have a minimum of 40 hours of 3000 and 4000 level courses in order to receive a baccalaureate degree. Please note: This may require the student to take up to ten (10 Hrs) of upper division elective hours in order to meet this graduation requirement.

**\*\***Biology major students may choose to replace a combination of the Biology major courses/electives with a Multidisciplinary option. (See Multidisciplinary options at the beginning of the Academic Degree program section).

Total Required Hours	123-125
Total Electives	6
Total Biology	70-72
Total Orientation	1
Total University Core	46

### Faculty/Senate Checklist – Approval of a <u>New Program</u> (Step #2)

MACU Faculty/Senate Policy Rev. 11-23-15

Do not change form wording

PURPOSE: Request for FINAL <u>Approval of a Biology Program</u> (Step #2) (new major, emphasis, concentration or certificate)

Proposed Program Name: B.S. Biology

Submitted by: Dr. Harold Kihega and Dr. Carol Fowlkes

College/School: School of Math and Science

#### Process to request approval of a new degree/emphasis/certificate program:

- <u>Prerequisite</u>: Approval of Step #1, Request to Develop a New Program at a previous Faculty and Senate meeting
- Fill out the attached Faculty/Senate Proposal form.
- Submit your completed proposal and required documentation to the persons listed below for signatures. You may email your proposal to reviewers and attach the email responses to this form keeping in mind the required approval order.
- Proposals with all required signatures should be submitted for inclusion on the Faculty agenda a minimum of 7 days prior to the scheduled meeting.
- Submit your proposal and all supporting documents to the Dean in one electronic Word file. No PDF documents.

#### **Required Signatures**

- 1. Obtain all signatures IN THE ORDER LISTED for purpose of appropriate collaboration, communication and approval.
- 2. The signature form must always accompany your proposal. You can expect revisions at all levels of review.
- 3. Changes requested at any level below should be made before you receive that reviewer's signature.
- 4. Submit your proposal to be listed on the next Faculty Meeting agenda: Upon receipt of notification of approval of your proposal from the VPAA Office submit an electronic copy of your proposal to the Dean's Administrative Assistant.

Approved: School Chair/Program Director	Date	Comments
Approved: College Dean	Date	Comments
Approved: Vice President for CAGS (CAGS Only)	Date	Comments
Reviewed: Marketing Representative –CAGS <u>or</u> Assist. V.P. Enrollment Services – CAS	Date	Comments
Reviewed: University Registrar	Date	Comments
Reviewed: Chief Financial Officer	Date	Comments
Reviewed: Executive Director of Assessment, Accreditation and Institutional Research	Date	Comments
Approved: Vice President for Academic Affairs	Date	Comments

MACU Faculty/Senate Policy Rev. 11-23-15

#### Name of New Program:

(Include full title and degree prior approval of Step #1 is required) Bachelor of Science in Biology

Proposal to Approve a New Program (Explain request/actions)

This proposal is to approve a program for a biology degree at MACU to begin fall of 2017. This proposal also includes approval requests for:

- New courses and course descriptions
- The establishment of two new departmental designations for courses: BIOL and CHEM,
- Revision of the NATS 2201, 2203, 2204 Biology and Lab courses to:
  - o Change the name of these courses to General Biology, General Biology Lab, and General Biology and Lab
  - o Add "This course is for non-Biology majors" to the course description.

Rationale (information supporting proposal-motivation, justification, reasoning; include documentation of sources of expected success of the new program)

Current research literature indicates there is a degree shortage in the U.S. for Science, Technology, Engineering, and Mathematics (STEM) degrees (United States Department of Labor, 2015). With the addition of a biology program, students will have an opportunity for exposure to STEM curriculum. Furthermore, biology is a topic that transcends a variety of subjects and opens the door to numerous career opportunities. The biology program will also prepare students who want to pursue a graduate degree in the many areas of biological sciences. It is our belief that Christians make the best biologist and/or health care providers.

**Recruitment Forecasting** (data supporting proposal and estimated student enrollment per semester for the next 3-5 years)

The recruitment goal for the biology program is to recruit 10 or more students per year on a continuing basis. According to the admissions office, a large percentage of interested students request biology or healthcare professional degrees.

#### Correlation to the Strategic Plan, Assessment System and Program Improvement

The SMS strategic plan reflects this program approval.

Objective 1 is to offer more majors within the School of Math and Science

Goal 1.1 Develop Biology major

Action Steps:

1.1.1 Develop program outcomes
1.1.2 Develop student outcomes
1.1.3 Write course descriptions for new courses to be added
1.1.4 Take proposal to approve program to faculty meeting after collecting necessary signatures
1.1.5 Begin advertising new major
1.1.6 Explore funding options for Chemistry/Microbiology Lab

The program outcomes for the biology program will be assessed using MACU's assessment guidelines on an annual basis. The student learning outcomes will be aligned to the program outcomes and will be assessed each semester as the courses are taught. Program improvements will then be made after analysis of assessment data.

Fill in all blanks

#### SUBMITTED BY:

• Name/Title

Harold Kihega, Ph.D. Associate Professor and Carol Fowlkes, Ph.D. Professor College of Arts and Sciences/School of Math and Science

College/School

# **Faculty/Senate Checklist – Approval of a** <u>New Program</u> (Step #2) MACU Faculty/Senate Policy Rev. 11-23-15

Proposed Effective Date:	August 1, 2017
Program Description	The biology program at MACU provides students with a strong foundation to enter multiple science careers, STEM graduate school, and professional health science programs. In addition to classroom and laboratory teaching modules, MACU provides abundant opportunities for faculty-to-peer mentorships, peer-to-peer collaborative learning, and critical thinking opportunities related to science research protocol.
Program Outcomes	<ul> <li>Graduates of the biology program will be able to:</li> <li>1) Effectively communicate the processes of scientific inquiry and core biological concepts through proficient use and understanding of scientific vocabulary.</li> <li>2) Apply critical thinking skills through evaluation of biological concepts that have withstood scientific inquiry and is accepted throughout the scientific community.</li> <li>3) Apply quantitative analysis to solve and interpret scientific problems.</li> <li>4) Apply scientific thinking to evaluate real world problems.</li> <li>5) Identify scientific problems and employ the correct research methodology to find solutions.</li> <li>6) Correctly use various scientific equipment while employing appropriate techniques using proper safety protocol.</li> </ul>
<b>Program Admission</b> <b>Requirements</b> (If already approved in major – state "no change"	MACU admission requirements

# **Faculty/Senate Checklist – Approval of a <u>New Program</u> (Step #2) MACU Faculty/Senate Policy Rev. 11-23-15**

	New Courses (*These courses will be offered beginning Spring 2017)
	BIOL 1114 Biology I (majors) Biology I is a course for biology majors. It is a systematic study of biological principles beginning at the molecular level and advancing to the cellular level. The concepts covered include prokaryote and eukaryote cell form and function, cell membrane transport, cell metabolism, cell energetics, protein synthesis, and genetics. Laboratory is a required and integral component introducing students to the scientific method, experimentation, and analytical evaluation. Offered every fall semester. *
	BIOL 1214 Biology II (majors) Biology II is the continuation of Biology I and is a course for biology majors. It is a systematic study of biological principles progressing to the ecological realm. The concepts covered include plant and animal form and function, taxonomy, evolution, biodiversity, and ecology. Laboratory is a required and integral component introducing students to research methods, dissection, and analytical evaluation. Offered every spring semester.
	BIOL 2114 General Zoology General Zoology is a course for biology majors. It is an introduction to animal form and function of invertebrates and vertebrates, concluding with animal behavior. The concepts covered include, animal form and function, taxonomy, physiological systems, anatomical comparisons, and conservation. Laboratory is a required and integral component introducing students to animal dissection and analytical evaluation. Prerequisite – C or better in BIOL 1114 Biology I, BIOL 1214 Biology II, or instructor approval. Offered every fall semester.
<u>New Courses</u> (use catalog format, include name, numbers, description, prerequisites), CAS – list course rotations CAGS list course length.	<ul> <li>BIOL 2214 General Botany General Botany is a course for biology majors. It is an introduction to the principles of botany, beginning at the cellular level and advancing to the organismal level. The concepts covered include plant anatomy, physiology, genetics, reproduction, and taxonomic relationships. Laboratory is a required and integral component introducing students to morphological comparisons and analytical evaluation. Prerequisite – C or better in BIOL 1114 Biology I, BIOL 1214 Biology II, or instructor approval. Offered every spring semester.</li> </ul>
	<ul> <li>BIOL 2314 Human Anatomy and Physiology I Human API is for students planning to major in nursing or other health professions. It is a comprehensive study of the structures and functions of cells, tissues, organs, organ systems, and the human body. The systems covered include, integumentary, skeletal, muscular and nervous. Laboratory is a required and integral component introducing students to dissection, and analytical evaluation.</li> <li>Prerequisite – C or better BIOL 1114 Biology I, BIOL 1214 Biology II, or instructor approval. Offered every fall semester. *</li> </ul>
	BIOL 2324 Human Anatomy and Physiology II Human APII is for students planning to major in nursing or other health professions. It is a comprehensive study of the structures and functions of cells, tissues, organs, organ systems, and the human body. The systems covered include, cardiovascular, lymphatic, endocrine, digestive, urinary and reproductive. Laboratory is a required and integral component introducing students to dissection, and analytical evaluation. Prerequisite - C or better in BIOL 2314 Human Anatomy and Physiology I, or instructor approval. Offered every spring semester.
	<ul> <li>BIOL 3114 Human Anatomy Human Anatomy is a course designed for students interested in the medical field. It is a comprehensive study of both microscopic and gross anatomical structures of the human body.</li> <li>Laboratory is a required and integral component introducing students to dissection, emphasizing human form and function, and analytical evaluation. Prerequisite – C or better BIOL 1114 Biology I, BIOL 1214 Biology II, or instructor approval.</li> </ul>
	BIOL 3214 Human Physiology Human Physiology is a systematic study introducing students to human body functions. The concepts covered includes, homeostatic regulation, cell interactions, enzyme, and hormonal influence of systems within the human body. Laboratory is a required and integral component introducing

students to physiological experimentation and analytical evaluation. Prerequisite – C or better in BIOL 1144 Biology I, BIOL 1214 Biology II, CHEM 1105 Chemistry I, or instructor approval.
<ul> <li>BIOL 3304 Microbiology (Replaces NATS 3304 Microbiology) Microbiology is a course for biology majors. It is a comprehensive study of microorganism form, physiology, reproduction, genetics and diversity. Laboratory is a required and integral component introducing students to microbiology laboratory techniques and analytical evaluation. Prerequisite – C or better in BIOL 1144 Biology I, BIOL 1214 Biology II, CHEM 1105 Chemistry I, or instructor approval.</li> </ul>
<ul> <li>BIOL 3334 Cell Biology Cell biology is a course for biology majors. It is a comprehensive study of prokaryotic and eukaryotic cells with a comparison in metabolism, energetics, and autogenous regulation, with an emphasis in biochemistry and cellular changes during the life cycle of cells. Laboratory is a required and integral component introducing students to laboratory techniques required to study cells.</li> <li>Prerequisite – C or better in BIOL 1144 Biology I, BIOL 1214 Biology II, CHEM 1105 Chemistry I, CHEM 1205 Chemistry II, or instructor approval.</li> </ul>
<ul> <li>BIOL 3354 Genetics</li> <li>Genetics is a course for biology majors. It is a comprehensive study of chromosomal aberrations, pedigree analysis, hereditary traits, DNA damage and repair, epigenetics, and genetic engineering. Laboratory is a required and integral component introducing students to Mendelian laws, mutations, natural and artificial selection. Prerequisite – C or better in BIOL 1144 Biology I, BIOL 1214 Biology II, CHEM 1105 Chemistry I, CHEM 1205 Chemistry II, or instructor approval.</li> </ul>
<ul> <li>BIOL 3363 Evolution Evolution is a course for biology majors. It is a comprehensive study of genetic mutations, genetic drift, population adaptations, and evolution by natural selection of various life forms.</li> <li>Prerequisite – C or better in BIOL 1144 Biology I, BIOL 1214 Biology II, CHEM 1105 Chemistry I, CHEM 1205 Chemistry II, or instructor approval.</li> </ul>
<ul> <li>BIOL 4124 Histology Histology is a course for biology majors. It is a comprehensive study of human and animal tissue with an emphasis in mammalian tissue form and function. Laboratory is a required and integral component introducing students to laboratory techniques required to study cells and tissue. Prerequisite – C or better in BIOL 1144 Biology I, BIOL 1214 Biology II, CHEM 1105 Chemistry I, CHEM 1205 Chemistry II, or instructor approval.</li> </ul>
<ul> <li>BIOL 4144 Plant Anatomy and Taxonomy Plant anatomy and taxonomy is a course for biology majors. It is a systematic study of vascular plant morphology and classification with an emphasis in Oklahoma trees and flowering plants. Laboratory is a required and integral part of this course with fieldwork included. Prerequisite – C or better in BIOL 1144 Biology I, BIOL 1214 Biology II, CHEM 1105 Chemistry I, CHEM 1205 Chemistry II, or instructor approval.</li> </ul>
<ul> <li>BIOL 4501 Biology Research</li> <li>This 1 hour course is required for all biology majors during their junior or senior year. It will cover past classic works and current research topics in STEM fields. An emphasis will be placed upon literature reviews, presentation of findings and scholarly communications. Prerequisite – MATH 3703 Introduction to Statistics.</li> </ul>
CHEM 1105 Chemistry I (Replaces NATS 1104 Chemistry I) Chemistry I is required course for biology and chemistry majors. It is a systematic study of atomic and molecular structure, chemical bonding properties, chemical reactions, stoichiometry and conservation of mass. Laboratory is a required and integral component to learning scientific experimentation safety protocol, and proper reporting of results. Prerequisite - ACT Math 22 or above, MATH 1103 College Algebra, or instructor approval.
CHEM 1205 Chemistry II (Replaces NATS 1204 Chemistry II)

# Faculty/Senate Checklist – Approval of a <u>New Program</u> (Step #2) MACU Faculty/Senate Policy Rev. 11-23-15

Chemistry II is required for biology and chemistry majors. It is a systematic study of chemical kinetics, intermolecular forces, reaction rates, thermochemistry, and electrochemistry. Laboratory is a required and integral component to learning scientific experimentation safety protocol, and proper reporting of results. Prerequisite – C or better in CHEM 1105 Chemistry I or instructor approval.
CHEM 2105 Organic Chemistry I Organic Chemistry I is a required for biology and chemistry majors. It is a systematic study of various organic molecules with an emphasis in stereochemistry, reactivity, nomenclature and classification of reaction types. Laboratory is a required and integral component to learning scientific experimentation safety protocol, measurements, spectroscopy, and separation techniques. Prerequisite – C or better in CHEM 1105 Chemistry I, CHEM 1205 Chemistry II, or instructor approval.
NATS 2101 Environmental Science Lab Laboratory experiences is an integral component introducing students to environmental issues and analysis. Offered every semester. *
NATS 2103 Environmental Science Environmental Science is open to all undergraduates. It is an introductory study of the basic principles of physical science as applied to ecology, current environmental problems and control measures, with an emphasis on human impact, modern technology, natural ecosystems, social, political, and economic processes. Offered every semester. *
<b>Revised Course Descriptions</b> : Current Course NATS 2201, 2203, 2204 Biology and Lab name, number, and course description change:
Change NATS 1011 Biology Lab to NATS 1201 General Biology Lab General Biology Lab is for the non-biology major. Laboratory experiences designed to facilitate understanding of the biological concepts principles studied in NATS 1013. A one hour lab session each week. Offered every semester.
Change NATS 2203 Biology to NATS 1013 General Biology (non-majors) General Biology is for the non-biology major. A study of past and present concepts regarding the growth, reproduction, structure, genetics, evolution, and interrelations of biological life. Offered every semester.
<ul> <li>Change NATS 2204 Biology and Lab to NATS 1014 General Biology and Lab (non-majors) General Biology and Lab is for the non-biology major. A study of past and present concepts regarding the growth, reproduction, structure, genetics, evolution, and interrelations of biological life.</li> <li>Lab - Laboratory experiences designed to facilitate understanding of the biological concepts. A one hour lab session each week. Offered every semester.</li> </ul>
Degree evaluation form attached.

MACU Faculty/Senate Policy Rev. 11-23-15

Major: Biology Degree: Bachelor of Science Effective Date: (8-1-2017)

#### University Core Specific courses within the University Core are listed on the first page of this catalog section.

#### University Core (46 Hrs)

Bible/Theology (12 hrs) Communication (9 hrs) U.S. History and Government (6 hrs) Science (7 hrs) \*NATS 2101 Environmental Science Lab \*NATS 2103 Environmental Science Math (3 hrs) \*MATH 1513 College Algebra Social Sciences (3 hrs) \*PSYC 1103 Intro to Psychology Humanities (6 hrs – 3 must be literature)

\*These courses are required pre-requisites for the major. Upon completion of the above courses, corresponding University Core requirements will be satisfied. (These courses are required for this major regardless of previous degrees conferred).

#### Orientation (1 hr)

UNIV 1121 Critical thought and pop culture

School: School of Math and Science College: College of Arts and Science

#### Major Requirements (70-71 hrs)

#### **Biology Core (29 hrs)**

BIOL 1144	Biology I
BIOL 1214	Biology II
BIOL 2114	General Zoology
BIOL 2214	General Botany

#### Anatomy/Physiology option

BIOL 2314	Anatomy and Physiology I and
BIOL 2324	Anatomy and Physiology II
or	
BIOL 3114	Human Anatomy ** <u>and</u>
BIOL 3214	Human Physiology **
BIOL 3304	Microbiology
BIOL 4501	Biology Seminar

#### **Biology Electives (Choose 15-16 Hrs)**

BIOL 3334	Cell Biology
BIOL 3354	Genetics
BIOL 3363	Evolution
BIOL 4124	Histology
BIOL 4144	Plant Taxonomy

#### Chemistry (15 hrs)

CHEM 1105	Chemistry I
CHEM 1205	Chemistry II
CHEM 2105	Organic Chemistry I

#### MATH/PHYS (11 hrs)

MATH 2114	Calculus 1
MATH 3703	Introduction to Statistics
PHYS 2104	Physics 1

\*\*Pre-Med track

#### Electives (6 hrs)

(Pre-Med choose	from these 3 PSYC courses)
PSYC 4703	Psychology of Abnormal Behavior
PSYC 3813	Cognitive Psychology
PSYC 4213	Physiological Psychology and Neuroscience

A student must have a minimum of 40 hours of 3000 and 4000 level courses in order to receive a Bachelor degree. Please note: This may require the student to take up to ten (10 Hrs) of upper division elective hours in order to meet this graduation requirement.

Total Required Hours	123-124
Total Electives	06
Total Biology	70-71
Total Orientation	01
Total University Core	46

MACU Faculty/Senate Policy Rev. 11-23-15

Do not change form wording

**PURPOSE:** Request for **FINAL** <u>Approval of a Biology Program</u> (Step #2) (new major, emphasis, concentration or certificate)

Proposed Program Name: B.S. Biology

Submitted by: Dr. Harold Kihega and Dr. Carol Fowlkes

College/School: School of Math and Science

### Process to request approval of a new degree/emphasis/certificate program:

- <u>Prerequisite</u>: Approval of Step #1, Request to Develop a New Program at a previous Faculty and Senate meeting
- Fill out the attached Faculty/Senate Proposal form.
- Submit your completed proposal and required documentation to the persons listed below for signatures. You may email your proposal to reviewers and attach the email responses to this form keeping in mind the required approval order.
- Proposals with all required signatures should be submitted for inclusion on the Faculty agenda a minimum of 7 days prior to the scheduled meeting.
- Submit your proposal and all supporting documents to the Dean in one electronic Word file. No PDF documents.

#### **Required Signatures**

- 1. Obtain all signatures IN THE ORDER LISTED for purpose of appropriate collaboration, communication and approval.
- 2. The signature form must always accompany your proposal. You can expect revisions at all levels of review.
- 3. Changes requested at any level below should be made before you receive that reviewer's signature.
- 4. Submit your proposal to be listed on the next Faculty Meeting agenda: Upon receipt of notification of approval of your proposal from the VPAA Office submit an electronic copy of your proposal to the Dean's Administrative Assistant.

Approved: School Chair/Program Director	Date	Comments
Approved: College Dean	Date	Comments
Approved: Vice President for CAGS (CAGS Only)	Date	Comments
Reviewed: Marketing Representative –CAGS <u>or</u> Assist. V.P. Enrollment Services – CAS	Date	Comments
Reviewed: University Registrar	Date	Comments
Reviewed: Chief Financial Officer	Date	Comments
Reviewed: Executive Director of Assessment, Accreditation and Institutional Research	Date	Comments
Approved: Vice President for Academic Affairs	Date	Comments
## Faculty/Senate Checklist – Approval of a <u>New Program</u> (Step #2)

MACU Faculty/Senate Policy Rev. 11-23-15

### Name of New Program:

(Include full title and degree prior approval of Step #1 is required) Bachelor of Science in Biology

### Proposal to Approve a New Program (Explain request/actions)

This proposal is to approve a program for a biology degree at MACU to begin fall of 2017. This proposal also includes approval requests for:

- New courses and course descriptions
- The establishment of two new departmental designations for courses: BIOL and CHEM,
- Revision of the NATS 2201, 2203, 2204 Biology and Lab courses to:
  - Change the name of these courses to General Biology, General Biology Lab, and General Biology and Lab
    - Add "This course is for non-Biology majors" to the course description.
- Revision of the University Core by adding NATS 1xx3, Environmental Science and NATS 1xx1, Environmental Science Lab to science options.

Rationale (information supporting proposal-motivation, justification, reasoning; include documentation of sources of expected success of the new program)

Current research literature indicates there is a degree shortage in the U.S. for Science, Technology, Engineering, and Mathematics (STEM) degrees. With the addition of a biology program, students will have an opportunity for exposure to STEM curriculum. Furthermore, biology is a topic that transcends a variety of subjects and opens the door to numerous career opportunities. The biology program will also prepare students who want to pursue a graduate degree in the many areas of biological sciences. It is our belief that Christians make the best biologist and/or health care providers.

Recruitment Forecasting (data supporting proposal and estimated student enrollment per semester for the next 3-5 years)

The recruitment goal for the biology program is to recruit 10 or more students per year on a continuing basis. According to the admissions office, a large percentage of interested students request biology or healthcare professional degrees.

### Correlation to the Strategic Plan, Assessment System and Program Improvement

The SMS strategic plan reflects this program approval.

Objective 1 is to offer more majors within the School of Math and Science

Goal 1.1 Develop Biology major

Action Steps:

1.1.1 Develop program outcomes
1.1.2 Develop student outcomes
1.1.3 Write course descriptions for new courses to be added
1.1.4 Take proposal to approve program to faculty meeting after collecting necessary signatures
1.1.5 Begin advertising new major
1.1.6 Explore funding options for Chemistry/Microbiology Lab

The program outcomes for the biology program will be assessed using MACU's assessment guidelines on an annual basis. The student learning outcomes will be aligned to the program outcomes and will be assessed each semester as the courses are taught. Program improvements will then be made after analysis of assessment data.

## Fill in all blanks

SUBMITTED BY:

• Name/Title

College/School

Harold Kihega, Ph.D. Associate Professor and Carol Fowlkes, Ph.D. Professor College of Arts and Sciences/School of Math and Science

# **Faculty/Senate Checklist – Approval of a** <u>New Program</u> (Step #2) MACU Faculty/Senate Policy Rev. 11-23-15

Proposed Effective Date:	August 1, 2017		
Program Description	The biology program at MACU provides students with a strong foundation to enter multiple science careers, STEM graduate school, and professional health science programs. In addition to classroom and laboratory teaching modules, MACU provides abundant opportunities for faculty-to-peer mentorships, peer-to-peer collaborative learning, and critical thinking opportunities related to science research protocol.		
Program Outcomes	<ol> <li>Graduates of the biology program will be able to:         <ol> <li>Effectively communicate the processes of scientific inquiry and core biological concepts through proficient use and understanding of scientific vocabulary.</li> <li>Apply critical thinking skills through evaluation of biological concepts that have withstood scientific inquiry and is accepted throughout the scientific community.</li> <li>Apply quantitative analysis to solve and interpret scientific problems.</li> <li>Apply scientific thinking to evaluate real world problems.</li> <li>Identify scientific problems and employ the correct research methodology to find solutions.</li> <li>Correctly use various scientific equipment while employing proper techniques using proper safety protocol.</li> </ol> </li> </ol>		
<b>Program Admission</b> <b>Requirements</b> (If already approved in major – state "no change"	MACU admission requirements		

# **Faculty/Senate Checklist – Approval of a <u>New Program</u> (Step #2) MACU Faculty/Senate Policy Rev. 11-23-15**

	BIOL 1xx4 Biology I Biology I is a course for biology majors. It is a systematic study of biological principles beginning at the molecular level and advancing to the cellular level. The concepts covered include prokaryote and eukaryote cell form and function, cell membrane transport, cell metabolism, cell energetics, protein synthesis, and genetics. Laboratory is a required and integral component introducing students to the scientific method, dissection, experimentation, and analytical evaluation. Offered every fall semester. *
DUFSES alog format, include unbers, description, isites), st course rotations st course length.	BIOL 1xx4 Biology II Biology II is the continuation of Biology I and is a course for biology majors. It is a systematic study of biological principles progressing to the ecological realm. The concepts covered include plant and animal form and function, taxonomy, evolution, biodiversity, and ecology. Laboratory is a required and integral component introducing students to research methods, dissection, and analytical evaluation. Offered every spring semester.
	You will need to separate these two courses and list the 1xx1, Environmental Science Lab as a separate course with a separate course description – if you are going to have two course numbers. NATS 1xx3 and NATS 1xx1 Environmental Science (new general education course required for all biology majors under the University Correl)
	Environmental Science is open to all undergraduates. It is an introduction to ecology, current environmental problems and control measures, with an emphasis on human impact, modern technology, natural ecosystems, social, political, and economic processes. Laboratory is a required and integral component introducing students to environmental issues and analysis. Offered every semester. *
	BIOL 2xx4 General Botany General Botany is a course for biology majors. It is an introduction to the principles of botany, beginning at the cellular level and advancing to the organismal level. The concepts covered include plant anatomy, physiology, genetics, reproduction, and taxonomic relationships. Laboratory is a required and integral component introducing students to dissection, experimentation, and analytical evaluation. Prerequisite – C or better in BIOL 1xx4 Biology I, BIOL 1xx4 Biology II, or instructor approval. Offered every spring semester.
	BIOL 2xx4 General Zoology General Zoology is a course for biology majors. It is an introduction to animal form and function of invertebrates, vertebrates and concluding with animal behavior. The concepts covered include, animal form and function, taxonomy, physiological system adaptations, anatomical comparisons, and conservation. Laboratory is a required and integral component introducing students to dissection, experimentation, and analytical evaluation. Prerequisite – C or better in BIOL 1xx4 Biology I, BIOL 1xx4 Biology II, or instructor approval. Offered every fall semester.
	<ul> <li>BIOL 2xx4 Human Anatomy and Physiology I Human API is for students planning to major in nursing or other health professions. It is a comprehensive study of the structures and functions of cells, tissues, organs, organ systems, and the human body. The systems covered include, integumentary, skeletal, muscular and nervous. Laboratory is a required and integral component introducing students to dissection, and analytical evaluation. Prerequisite – C or better in BIOL 1xx4 Biology I, BIOL 1xx4 Biology II, or instructor approval. Offered every fall semester. *</li> </ul>
	BIOL 2xx4 Human Anatomy and Physiology II Human APII is for students planning to major in nursing or other health professions. It is a comprehensive study of the structures and functions of cells, tissues, organs, organ systems, and the human body. The systems covered include, cardiovascular, lymphatic, endocrine, digestive, urinary and reproductive. Laboratory is a required and integral component introducing students to dissection, and analytical evaluation. Prerequisite - C or better in BIOL 2xx4 Human Anatomy and Physiology I, or instructor approval. Offered every spring semester.

## BIOL 2xx4 Human Anatomy

Human Anatomy is a course designed for students interested in the medical field. It is a comprehensive study of both microscopic and gross anatomical structures of the human body. Laboratory is a required and integral component introducing students to dissection emphasizing form

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## Faculty/Senate Checklist – Approval of a <u>New Program</u> (Step #2)

MACU Faculty/Senate Policy Rev. 11-23-15

and function, and analytical evaluation. Prerequisite – C or better in BIOL 1xx4 Biology I, BIOL 1xx4 Biology II, or instructor approval.

### BIOL 2xx4 Human Physiology

Human Physiology is a systematic study introducing students to human body functions. The concepts covered includes, homeostatic regulation, cell interactions, enzyme, and hormonal influence of systems within the human body. Laboratory is a required and integral component introducing students to physiological experimentation and analytical evaluation. Prerequisite – C or better in BIOL 1xx4 Biology I, BIOL 1xx4 Biology II, CHEM 1xx5 Chemistry I, or instructor approval.

### BIOL 3xx4 Microbiology (Replaces NATS 3304 Microbiology)

Microbiology is a course for biology majors. It is a comprehensive study of microorganism form, physiology, reproduction, genetics and diversity. Laboratory is a required and integral component introducing students to microbiology laboratory techniques and analytical evaluation. Prerequisite – C or better in BIOL 1xx4 Biology I, BIOL 1xx4 Biology II, CHEM 1xx5 Chemistry I, or instructor approval.

#### **BIOL 3xx4 Genetics**

Genetics is a course for biology majors. It is a comprehensive study of chromosomal aberrations, pedigree analysis, hereditary traits, DNA damage and repair, epigenetics, and genetic engineering. Laboratory is a required and integral component introducing students to Mendelian laws, mutations, natural and artificial selection. Prerequisite – C or better in BIOL 1xx4 Biology I, BIOL 1xx4 Biology II, CHEM 1xx5 Chemistry I, CHEM 1xx5 Chemistry II, or instructor approval.

### BIOL 3xx4 Cell Biology

Cell biology is a course for biology majors. It is a comprehensive study of prokaryotic and eukaryotic cells with a comparison in metabolism, energetics, and autogenous regulation, an emphasis in biochemistry and cellular changes during the life cycle of cells. Laboratory is a required and integral component introducing students to laboratory techniques required to study cells. Prerequisite – C or better in BIOL 1xx4 Biology I, BIOL 1xx4 Biology II, CHEM 1xx5 Chemistry I, CHEM 1xx5 Chemistry II, or instructor approval.

#### BIOL 3xx3 Evolution

Evolution is a course for biology majors. It is a comprehensive study of genetic mutations, genetic drift, population adaptations, and evolution by natural selection of various life forms. Prerequisite – C or better in BIOL 1xx4 Biology I, BIOL 1xx4 Biology II, CHEM 1xx5 Chemistry I, CHEM 1xx5 Chemistry II, or instructor approval.

#### **BIOL 4xx4 Histology**

Histology is a course for biology majors. It is a comprehensive study of human and animal tissue with an emphasis in mammalian tissue form and function. Laboratory is a required and integral component introducing students to laboratory techniques required to identify cells and tissue. Prerequisite – C or better in BIOL 1xx4 Biology I, BIOL 1xx4 Biology II, CHEM 1xx5 Chemistry I, CHEM 1xx5 Chemistry II, or instructor approval.

#### **BIOL 4xx4 Plant Anatomy and Taxonomy**

Plant anatomy and taxonomy is a course for biology majors. It is a systematic study of vascular plant morphology and classification with an emphasis in Oklahoma trees and flowering plants. Laboratory is a required and integral part of this course with fieldwork included. Prerequisite – C or better in BIOL 1xx4 Biology I, BIOL 1xx4 Biology II, CHEM 1xx5 Chemistry I, CHEM 1xx5 Chemistry II, or instructor approval.

### BIOL 4xx1 Biology Research

This 1 hour course is required for all biology majors their junior or senior year. It will cover past classic works and current research topics in STEM fields. An emphasis will be placed upon literature reviews, presentation of findings and scholarly communications. Prerequisite – MATH 3703 Introduction to Statistics.

CHEM 1xx5 Chemistry I (Replaces NATS 1104 Chemistry I) Chemistry I is required course for biology and chemistry majors. It is a systematic study of

# **Faculty/Senate Checklist – Approval of a** <u>New Program</u> (Step #2) MACU Faculty/Senate Policy Rev. 11-23-15

atomic and molecular structure, chemical bonding properties, chemical reactions, stoichiometry and conservation of mass. Laboratory is a required and integral component to learning scientific experimentation safety protocol, and reporting results. Prerequisite - ACT Math 22 or above, MATH 1103 College Algebra, or instructor approval.
<ul> <li>CHEM 1xx5 Chemistry II (Replaces NATS 1204 Chemistry II)</li> <li>Chemistry II is required for biology and chemistry majors. It is a systematic study of chemical kinetics, intermolecular forces, reaction rates, thermochemistry, and electrochemistry. Laboratory is a required and integral component to learning scientific experimentation safety protocol, and reporting results. Prerequisite – C or better in CHEM 1xx5 Chemistry I or instructor approval.</li> </ul>
CHEM 2xx5 Organic Chemistry I Organic Chemistry I is a required for biology and chemistry majors. It is a systematic study of various organic molecules with an emphasis in stereochemistry, reactivity, nomenclature and classification of reaction types. Laboratory is a required and integral component to learning scientific experimentation safety protocol, measurements, spectroscopy, and separation techniques. Prerequisite – C or better in CHEM 1xx5 Chemistry I, CHEM 1xx5 Chemistry II, or instructor approval.
Revised Course Descriptions: Current Course NATS 2201, 2203, 2204 Biology and Lab change: Remove NATS 2201? Change NATS 2203 Biology to NATS 1xx3 General Biology General Biology is for the non-biology major. A study of past and present concepts regarding the origin, growth, reproduction, structure, genetics, evolution, and interrelations of biological life. Offered every semester.
<ul> <li>Change NATS 2204 Biology and Lab to NATS 1xx4 General Biology and Lab</li> <li>General Biology and Lab is for the non-biology major. A study of past and present concepts</li> <li>regarding the origin, growth, reproduction, structure, genetics, evolution, and interrelations of</li> <li>biological life. Lab - Laboratory experiences designed to facilitate understanding of the biological</li> <li>concepts principles. A one hour lab session each week. Offered every semester.</li> </ul>
*These courses will be offered beginning Spring 2017 (the asterisk had changed to a dot) Not sure about the question about NATS 2201?
Degree evaluation form attached.

## Faculty/Senate Checklist – Approval of a New Program (Step #2)

MACU Faculty/Senate Policy Rev. 11-23-15

Major: Biology Degree: Bachelor of Science Effective Date: (8-1-2017)

### University Core Specific courses within the University Core are listed on the first page of this catalog section.

### University Core (46 Hrs)

Bible/Theology (12 hrs) Communication (9 hrs) U.S. History and Government (6 hrs) Science (7 hrs) \*NATS xxx4 Environmental Science Math (3 hrs) \*MATH 1513 College Algebra Social Sciences (3 hrs) \*PSYC 1103 Intro to Psychology Humanities (6 hrs – 3 must be literature)

\*These courses are required pre-requisites for the major. Upon completion of the above courses, corresponding University Core requirements will be satisfied. (These courses are required for this major regardless of previous degrees conferred).

NATS xxx4 Environmental Science

### **Orientation** (1 hr)

UNIV 1121 Critical thought and pop culture

School: School of Math and Science College: College of Arts and Science

### **Major Requirements**

### Biology (44-45 hrs)

	/
BIOL 1xx4	Biology I
BIOL 1xx4	Biology II
BIOL 2xx4	General Zoology
BIOL 2xx4	General Botany
BIOL 2xx4	Anatomy and Physiology I or
BIOL 2xx4	Human Physiology
BIOL 2xx4	Anatomy and Physiology II or
BIOL 2xx4	Human Anatomy (Pre-Med)
BIOL 3xx4	Microbiology
BIOL 4xx1	Biology Seminar

### (Choose 15-16 Hrs)

BIOL 3xx4	Cell Biology
BIOL 3xx4	Genetics
BIOL 3xx3	Evolution
BIOL 4xx4	Histology
BIOL 4xx4	Plant Taxonomy

### Chemistry (15 hrs)

CHEM 1xx5	Chemistry I
CHEM 1xx5	Chemistry II
CHEM 2xx5	Organic Chemistry I

### MATH/PHYS (11 hrs)

MATH 2114	Calculus 1
MATH 3703	Introduction to Statistics
PHYS 2104	Physics 1

### Electives (6 hrs)

(Pre-Med choose from these 3 PSYC courses)		
PSYC 4703	Psychology of Abnormal Behavior	
PSYC 3813	Cognitive Psychology	
PSYC 4213	Physiological Psychology and Neuroscience	

Total Required Hours	123-124
Total Electives	06
Total Math/Phys	11
Total Chemistry	15
Total Biology	44-45
Total Orientation	01
Total University Core	46

# Rationale and Request:

With the current status of the new Biology Program at Mid-America Christian University (MACU) the School of Math and Science (SMS) is searching for additional lab space with an emphasis in saving money. Currently there are 32 students on the advisee list for the Biology Program, and recently Malcolm Mann (MACU recruiter) informally spoke of increased student interest in the area of Biology while recruiting for MACU.

Currently KH110 in Kennedy Hall is utilized for several lab courses including: Biology I, Anatomy and Physiology I, General Zoology, and Environmental Science - when it is offered as a traditional "in class" course. In the upcoming school year the SMS is projecting the addition of at least 30 new incoming STEM majors. Furthermore, SMS is poised to offer additional courses that require lab space such as: Upper Division Histology, Human Physiology, Anatomy and Physiology II, Biology II, and General Botany for current students. The search for additional (needed) lab space has piqued interest in the conversion of KH111 in Kennedy Hall in to another lab room. This would allow common materials to be shared and stored within the same area for different courses that may be offered within the same semester. It must be noted that the lab courses projected to meet in both KH110 and KH111 will emit minimal odor (consideration for other employees and students). Below is a map that represents the projected conversion:



We should consider desk height lab tables to be ADA compliant for future students that might be disabled. Currently, KH110 is not compliant.

## **PURPOSE: Request for Approval of Curriculum Revisions**

**Curriculum** proposal for: Removal of Concepts of Physics, addition of General Physics 1 and 2. Course number changes to Organic Chemistry I and II and Organic Laboratory addition

Submitted by:Dr. Harold Kihega and Dr. Carol Fowlkes College/School\_School of Math and Science\_Date: 11/16/2018

## **Process to request approval to revise an existing degree program/concentration/emphasis:**

- Fill out the attached Faculty/Senate Proposal form. *Note: this form is <u>not</u> for use to change an existing program into a new degree or emphasis. (approval to develop is <u>not</u> required for any items on this list)*
- Submit your completed proposal and required documentation to the persons listed below for signatures. You may email your proposal to reviewers and attach the email responses to this form keep in mind the required approval order.
- Proposals with all required signatures should be submitted for inclusion on the Faculty agenda a minimum of 7 days prior to the scheduled meeting.
- Submit your proposal and all supporting documents to the Dean in one electronic Word file. No PDF documents.

Curriculum components	<b>What is needed</b> (show changes in strikeout and highlights format, e.g., old and new format )	
<b>Requested change for:</b>	Use the MACU Catalog for information and format examples	
Admission requirements		
Course description		
Degree Program name	Submit your completed proposal form showing all revised or new information.	
Program description		
Program outcomes		
Course (information	Submit your completed proposal form and revised degree evaluation form ( <i>if applicable</i> ) (A course	
changes)	change includes changes in name, department, prefix, number, level, pre-requisites, and credit hours)	
Course (new)	Submit proposal form with course name, prefix, and course description and (CAS) semester rotation	
	and/or (CAGS) length of course use catalog format) and revised degree evaluation form (if applicable)	
Degree evaluation form	Submit your completed proposal form and revised degree evaluation form (the University Registrar or	
(degree sheet)	VPAA Office will assist with these changes)	

### Required Signatures

- 1. Obtain all signatures IN THE ORDER LISTED for purpose of appropriate collaboration, communication and approval.
- 2. The signature form must always accompany your proposal. You can expect revisions at all levels of review.
- 3. Changes requested at any level below should be made before you receive that reviewer's signature.
- 4. Submit your proposal to be listed on the next Faculty Meeting agenda: Upon receipt of notification of approval of your proposal from the VPAA Office submit an electronic copy of your proposal to the Dean's Administrative Assistant.

Approved: School Chair/Program Director	Date	Comments
Approved: College Dean	Date	Comments
Approved: Vice President for CAGS (CAGS Only)	) Date	Comments
Reviewed: University Registrar	Date	Comments
Reviewed: Director of Institutional Effectiveness	Date	Comments
Approved: Vice President for Academic Affairs	Date	Comments

### Proposal Request to Make Changes to Existing <u>Curriculum or for new</u>

**<u>courses:</u>** (state primary area of change – name of revised degree, new or revised course, etc.)

Proposal to Change: Change CHEM 2105 Organic Chemistry I to CHEM 2103, Change CHEM 2205 Organic Chemistry II to CHEM 2203, Add CHEM 2102 Organic Chemistry Laboratory. Change PHYS 1133 Concepts of Physics to PHYS 1133 General Physics 1. Remove PHYS 1131 Concepts of Physics Lab and add PHYS 1134 General Physics 1 including lab. Add PHYS 1234 General Physics II including lab and PHYS 1233 General Physics II

Proposal to Change - explain revisions and actions being requested (show changes in strikeout and highlights, e.g., old and new format)

### Current from catalog:

CHEM 2105 Organic Chemistry I (5 cr.) Organic Chemistry I is a required for biology and chemistry majors. It is a systematic study of various organic molecules with an emphasis in stereochemistry, reactivity, nomenclature and classification of reaction types. Laboratory is a required and integral component to learning scientific experimentation safety protocol, measurements, spectroscopy, and separation techniques. Prerequisite: C or better in CHEM 1105 Chemistry I, CHEM 1205 Chemistry II, or instructor approval.

CHEM 2205 Organic Chemistry II (5 cr.) Organic Chemistry II is a continuation of CHEM 2105. It is a systematic study of various organic molecules, advanced stereochemistry, chemical reactivity, organic reaction mechanisms, and methods for organic molecule synthesis. Laboratory is a required and integral component to learning scientific experimentation safety protocol, measurements, and synthesis, purification, and separation techniques. Prerequisite: C or better in CHEM 2105, or instructor approval.

PHYS 1131 Concepts of Physics I Lab (1 cr.) Laboratory experiences designed to facilitate understanding of the physics concept and principles studied in PHYS 1133. Offered every fall semester.

PHYS 1133 Concepts of Physics I Laboratory Physics I (3 cr.) This course uses algebra and trigonometry-based mathematical models to introduce the fundamental concepts that describe the physical world. Topics include units and measurement, vectors, linear kinematics and dynamics, energy, power, momentum, fluid mechanics, and heat. Upon completion students should be able to demonstrate an understanding of the principals involved and display analytical problem solving ability for the topics covered. Offered every fall semester.

### Proposed Changes:

CHEM 2103 Organic Chemistry I (3 cr.) Organic Chemistry I is a required for biology and chemistry majors. It is a systematic study of various organic molecules with an emphasis in stereochemistry, reactivity, nomenclature and classification of reaction types. Prerequisite: C or better in CHEM 1105 Chemistry I, CHEM 1205 Chemistry II, or instructor approval.

CHEM 2203 Organic Chemistry II (3 cr.) Organic Chemistry II is a continuation of CHEM 2105. It is a systematic study of various organic molecules, advanced stereochemistry, chemical reactivity, organic reaction mechanisms, and methods for organic molecule synthesis. Prerequisite: C or better in CHEM 2103, or instructor approval.

CHEM 2102 Organic Chemistry Laboratory (2 cr) Organic Laboratory is a required and integral component to learning scientific experimentation safety protocol, measurements, and synthesis, purification, and separation techniques. Prerequisite: C or better in CHEM 2103 or concurrent enrollment in CHEM 2103.

PHYS 1133 General Physics I (3 cr.) General Physics I is an algebra based course. This course includes mechanics in one and two dimensions, thermodynamics and/or waves. Prerequisite: College Algebra or equivalent.

PHYS 1134 General Physics I (4 cr.) General Physics I is an algebra based course. This course includes mechanics in one and two dimensions, thermodynamics and/or waves; with laboratory. Prerequisite: College Algebra or equivalent.

PHYS 1233 General Physics II (3 cr.) General Physics II is an algebra based course. This course is a continuation of PHYS 1133 and includes electricity and magnetism, light, thermodynamics and/or waves, and may also include modern physics. Prerequisite: PHYS 1133.

PHYS 1234 General Physics II (4 cr.) General Physics II is an algebra based course. This course is a continuation of PHYS 1134 and includes electricity and magnetism, light, thermodynamics and/or waves, and may also include modern physics; with laboratory. Prerequisite: PHYS 1134.

We are proposing the credit hour change to Organic Chemistry I and II so that students have the option of taking the lab with either course. This is consistent with other universities in our state.

We are proposing changing our general education algebra-based physics course – Concepts of Physics to the more acceptable General Physics for Course Equivalency Program purposes. Students pursuing any medical degree have requirements of general physics 1 and II so we are proposing the addition of General Physics II. General Physics I will still be a course in the University Core as an option for the science requirement for all students.

Other information (show new courses, course description changes, etc.)

CHEM 2102 Organic Chemistry Laboratory (2 cr) Organic Laboratory is a required and integral component to learning scientific experimentation safety protocol, measurements, and synthesis, purification, and separation techniques. Prerequisite: C or better in CHEM 2103 or concurrent enrollment in CHEM 2103.

PHYS 1134 General Physics I (4 cr.) General Physics I is an algebra based course. This course includes mechanics in one and two dimensions, thermodynamics and/or waves; with laboratory. Prerequisite: College Algebra or equivalent.

PHYS 1233 General Physics II (3 cr.) General Physics II is an algebra based course. This course is a continuation of PHYS 1133 and includes electricity and magnetism, light, thermodynamics and/or waves, and may also include modern physics. Prerequisite: PHYS 1133.

PHYS 1234 General Physics II (4 cr.) General Physics II is an algebra based course. This course is a continuation of PHYS 1134 and includes electricity and magnetism, light, thermodynamics and/or waves, and may also include modern physics; with laboratory. Prerequisite: PHYS 1134.

Correlation to the Assessment System & Program Improvement

These courses will be aligned to current program outcomes as part of annual review process

Budget and Correlation to Strategic Planning (include additional adjunct or any other expected costs)

No change to budget

**Other** (Attach all pertinent degree program evaluation forms showing revisions *with strikeout and highlights, e.g., old and new format*)

SUBMITTED BY: • Name/Title • College/School	Dr Harold Kihega, Dr. Carol Fowlkes/Co-Chairs of the School of Math and Science College of Arts and Sciences/School of Math and Science
Proposed Effective Date:	

# Faculty/Senate Checklist – <u>Develop</u> (Step #1)

MACU Faculty/Senate Policy Rev 11-23-15

Do not change form wording

**PURPOSE: Checklist to request approval** <u>to Develop</u> a New Program (Step #1) (*new major, emphasis, concentration or certificate*)

Name of the new degree/emphasis/certificate to be developed: Biology

Submitted by: Carol Fowlkes

College/School CAS School of Math and Science

## Process to request approval "To Develop" a new degree/emphasis/certificate program:

- Fill out the attached Faculty/Senate Proposal form.
- Submit your completed proposal and required documentation to the persons listed below for signatures. You may email your proposal to reviewers and attach the email responses to this form keeping in mind the required approval order.
- Proposals with all required signatures should be submitted for inclusion on the Faculty agenda a minimum of 7 days prior to the scheduled meeting.
- Submit your proposal and all supporting documents to the Dean in one electronic Word file. No PDF documents.

## **Required Signatures**

- 1. Obtain all signatures IN THE ORDER LISTED for purpose of appropriate collaboration, communication and approval.
- 2. The signature form must always accompany your proposal. You can expect revisions at all levels of review.
- 3. Changes requested at any level below should be made before you receive that reviewer's signature.
- 4. Submit your proposal to be listed on the next Faculty Meeting agenda: Upon receipt of notification of final approval of your proposal from the VPAA Office - submit an electronic copy of your proposal to the Dean's Administrative Assistant.

Approved: School Chair/Program Director	Date	Comments
Approved: College Dean	Date	Comments
Approved: Vice President for CAGS (CAGS Only)	Date	Comments
Reviewed: Marketing Representative –CAGS <u>or</u> Assist. V.P. Enrollment Services – CAS	Date	Comments
Reviewed: University Registrar	Date	Comments
Reviewed: Chief Financial Officer	Date	Comments
Reviewed: Executive Director of Assessment, Accreditation and Institutional Research	Date	Comments
Approved: Vice President for Academic Affairs	Date	Comments

# Faculty/Senate Checklist – <u>Develop</u> (Step #1) MACU Faculty/Senate Policy Rev 11-23-15

Proposed Degree Program Name: Full information including degree.	Proposal to Develop a biology program in the	e School of Math and Science	
Proposal (explain request)			
The School of Math and Sci expected to consist of 60+ h	The School of Math and Science is requesting approval to develop a biology program to begin Fall 2016. The degree is expected to consist of 60+ hours in biology, including Chemistry, physics, and mathematics courses.		
Rationale (information supp expected success of the new	porting proposal – motivation, justification, reason program)	ing; include documentation and sources of	
Research has shown that the attractive to students. The c	ere are many job opportunities in STEM fields. We reation of a biology major will serve to attract stud	e anticipate that this program will prove to be ents to MACU that are interested in pre-med,	
Recruitment Forecasting (	data supporting proposal and estimated student en	prollment per semester for the next 3-5 years)	
nursing, biological sciences			
Two of the highest requested majors according to the recruitment office are pre-med and nursing. This would be an attractive major to draw more students to MACU.			
Program improvement mod	als show that the addition of majors enhances stude	ent numbers. The School of Math and	
Science anticipates that a bi	ology program would produce growth at MACU w	ith recruitment efforts	
<b>Budget and Correlation to Strategic Planning</b> (include additional equipment, writing or development expenses, adjunct instructors and other expected costs; Note: HLC requires dedicated full time faculty for a new degree program-not required for emphasis or concentration.			
The School of Math and Science has included the addition of a biology program in their Strategic Plan for many years.According to comparable area schools, there will be a proposed 50-60 hours of biology courses such as Biology 1 (will not be a new course), Biology 2, Microbiology, Cells and systems, Molecular biology, plant and animal biology, etc. There will be at least 8 hours of Chemistry, and at least 4 hours of physics (not new). Most programs require a higher level math course such as Calculus which would not be a new course. The strategy involves articulation agreements with OCCC for two chemistry courses. There will need to be an additional full-time faculty member. There will be additional budget increases for consumable lab supplies as most biology courses are lab courses. 2016-17 biology 1 and 2 lab equipment (biology 1 will not be a new expense)\$1600 \$1600 \$1000 lab equipment +\$3600 adjunct \$1600 adjunct \$1600 lab equipment \$1600 lab equipment \$1600 lab equipment			
SUBMITTED BY: • Name/Title • College/School	Carol Fowlkes-Chair of the School of Math and S College of Arts and Sciences/School of Math and	Science Science	

# **Faculty/Senate Checklist** – <u>Develop</u> (Step #1) MACU Faculty/Senate Policy Rev 11-23-15

Proposed Effective Date:	Fall 2016
<b>Program Description</b> (Proposed brief description to show program concept)	The B.S. in Biology provides a comprehensive understanding of the nature of Biology and its relation to the other sciences, philosophy and liberal arts. In addition to general education and Bible coursework, course topics include biology, microbiology, genetics, molecular biology, chemistry, and physics to provide a foundation on which graduates may begin a career in medicine, physical therapy, pharmacy, nursing, environmental sciences, and other health related vocations.

MACU Faculty/Senate Policy Rev. 11/09/2016 Do not change wording on this form

## PURPOSE: Request for Approval of Curriculum Revisions

Curriculum proposal for: Biology Program

Submitted by: Dr. Kihega and Dr. Fowlkes College/School School of Math and Science Date: 2/22/17

## Process to request approval to revise an existing degree program/concentration/emphasis:

- Fill out the attached Faculty/Senate Proposal form. *Note: this form is <u>not</u> for use to change an existing program into a new degree or emphasis. (approval to develop is <u>not</u> required for any items on this list)*
- Submit your completed proposal and required documentation to the persons listed below for signatures. You may email your proposal to reviewers and attach the email responses to this form keep in mind the required approval order.
- Proposals with all required signatures should be submitted for inclusion on the Faculty agenda a minimum of 7 days prior to the scheduled meeting.
- Submit your proposal and all supporting documents to the Dean in one electronic Word file. No PDF documents.

Curriculum components	What is needed (show changes in strikeout and highlights format, e.g., old and new format )
<b>Requested change for:</b>	Use the MACU Catalog for information and format examples
Admission requirements	
Course description	
Degree Program name	Submit your completed proposal form showing all revised or new information.
Program description	
Program outcomes	
Course (information	Submit your completed proposal form and revised degree evaluation form ( <i>if applicable</i> ) (A course
changes)	change includes changes in name, department, prefix, number, level, pre-requisites, and credit hours)
Course (new)	Submit proposal form with course name, prefix, and course description and (CAS) semester rotation
	and/or (CAGS) length of course use catalog format) and revised degree evaluation form ( <i>if applicable</i> )
Degree evaluation form	Submit your completed proposal form and revised degree evaluation form (the University Registrar or
(degree sheet)	VPAA Office will assist with these changes)

### Required Signatures

- 1. Obtain all signatures IN THE ORDER LISTED for purpose of appropriate collaboration, communication and approval.
- 2. The signature form must always accompany your proposal. You can expect revisions at all levels of review.
- 3. Changes requested at any level below should be made before you receive that reviewer's signature.
- 4. Submit your proposal to be listed on the next Faculty Meeting agenda: Upon receipt of notification of approval of your proposal from the VPAA Office submit an electronic copy of your proposal to the Dean's Administrative Assistant.

Approved: School Chair/Program Director	Date	Comments
Approved: College Dean	Date	Comments
Approved: Vice President for CAGS (CAGS Only	) Date	Comments
Reviewed: University Registrar	Date	Comments
Reviewed: Director of Institutional Effectiveness	Date	Comments
Approved: Vice President for Academic Affairs	Date	Comments

## Proposal Request to Make Changes to Existing <u>Curriculum or for new</u>

**<u>courses:</u>** (state primary area of change – name of revised degree, new or revised course, etc.)

# Proposal to Change: Add 1xx3 General Nutrition and 4xx3 History of Science to Biology program

Change NATS 3403 Ecology for Teachers and NATS 3401 Ecology for Teachers lab to BIOL 3404 Ecology

Change Biology program sheet to reflect these additional course offerings

**Proposal to Change -** explain revisions and actions being requested (show changes in strikeout and highlights, e.g., old and new format)

The School of math and science would like to offer two additional courses to the biology program. The General Nutrition course is a 3 hour course that is required for those biology students pursuing nursing. We would like to offer History of Science to add an upper division course for biology students. Ecology for teachers is already in the catalog and we would simply like to change the prefix to BIOL and just name the course ecology to be consistent with other biology programs.

### **Rationale** (information supporting proposal – why you are making changes)

The School of Math and Science is adding two additional courses to the biology program. These courses will serve several purposes.

- 1. Nutrition is required for certain health sciences programs.
- 2. Nutrition will also be a required course if MACU develops a Health and Physical education degree in the future.
- 3. History of Science will give biology majors more options when choosing upper division coursework.
- 4. History of Science will also give History majors another option for upper division coursework.

Renaming and renumbering the Ecology course will enhance the degree program by giving biology majors a specialized area of study such as Organismal biology.

### Other information (show new courses, course description changes, etc.)

Course Descriptions:

BIOL 1xx3 General Nutrition

General Nutrition is required for certain pre-health professions. The course covers topics related to nutritional requirements to maintain homeostasis within the human body. Topics include chemical composition of macro and micronutrients, essential and nonessential nutrients, digestion, cell metabolism, energetics, and diseases related to diet.

### BIOL 4xxx3 History of Science

This course surveys historical science discoveries, principal events, and the progression of scientific methodologies within the biological and physical sciences. Critical evaluations of major scientific works beginning with Greek philosophers and progressing through the modern era will be emphasized.

The course description for the Ecology course will remain the same as current catalog course description.

Correlation to the Assessment System & Program Improvement

The new courses will be correlated to the assessment system to assure

Budget and Correlation to Strategic Planning (include additional adjunct or any other expected costs)

The addition/revision of the new courses will not affect the budget. These will be taught by adjunct professors but will just be an offering on a rotation.

Other (Attach all pertinent degree program evaluation forms showing revisions with strikeout and highlights, e.g., old and new format)

SUBMITTED BY: • Name/Title • College/School	
Proposed Effective Date:	

### BIOL 1xx3 General Nutrition

General Nutrition is required for certain pre-health professions. The course covers topics related to nutritional requirements to maintain homeostasis within the human body. Topics include chemical composition of macro and micronutrients, essential and nonessential nutrients, digestion, cell metabolism, energetics, and diseases related to diet. Offered every semester.

### BIOL 4xxx3 History of Science

This course surveys historical science discoveries, principal events, and the progression of scientific methodologies within the biological and physical sciences. Critical evaluations of major scientific works beginning with Greek philosophers and progressing through the modern era will be emphasized. Prerequisite - C or better in 9 hours in upper division coursework, or instructor approval.

# Biology, Program Review, Section 17

External Review Documents (advisory boards, accrediting bodies, etc.) or Other Substantive Evidence (i.e., student test scores on nationally-normed exam)

## Lab Room Requirements

## Lab Room 1: (Completed)

General Biology and Environmental Courses can share one lab room (possibly CR137) (**Both Funded by Otoe-Missouria Tribe**)

## Lab Room 2: (Completed)

Biology courses that can share lab room KH110 (Majors) (\*Funded by Otoe-Missouria Tribe)

\*Biology I \*Biology II \*General Zoology \*General Botany Plant Anatomy and Taxonomy

## Lab Room 3: (Need)

Biology courses that can share a lab room \*Anatomy and Physiology I \*Anatomy and Physiology II Human Physiology

## Lab Room 4: (Need)

Biology courses that can share a lab room Genetics Cell Biology Histology

### Lab Room 5 and \*\*6: (Need)

Biology courses that require additional equipment and that will require its own lab room Microbiology (one dedicated lab room)

Human Anatomy (one dedicated lab room) \*\* IF we use 3-D cadavers we can use Lab Room 3 thus eliminating Lab Room 6.

## Lab Room 6: (IF we don't move Human Anatomy to Lab Room 3)

Chemistry courses that can share a lab room Chemistry I

Chemistry II Organic Chemistry I Organic Chemistry II

# Introduction

As of July 18, 2018 the biology program has approximately 46 student majors. According to the original 5-year plan developed in July 2016, the fall of 2018 is the second year to offer courses for biology majors. Since the original plan, the Otoe-Missouria tribe funded MACU \$20,000.00. This funding put the biology department ahead of schedule by approximately one year. The primary goal for the MACU biology program is to produce the best scientists, researchers, and health care providers with a near 100% acceptance rate into graduate schools and professional schools, such as nursing, medical, physicians assistant, etc.

# <u>Rationale</u>

Beginning the fall of 2018 there are approximately 12 upperclassmen who will need combinations of the courses listed below (depending on concentration) starting fall 2019. These students have completed the majority of their university core. Although some of these courses fall under biology electives, they should be offered on a regular rotating basis.

BIOL 3114	Human Anatomy
BIOL 3305	Microbiology
BIOL 3334	Cell Biology
BIOL 3354	Genetics
BIOL 3363	Evolution
BIOL 3404	Ecology
BIOL 4124	Histology
BIOL 4144	Plant Taxonomy
BIOL 4213	History of Science
BIOL 4314	Embryology
BIOL 4501	Biology Seminar
BIOL 4901	Special Topics in Biology

As an example: Student A (premed) may desire to take a number of different combinations of the above courses. Each student may modify their program of study that is best suited for their particular medical school requirements.

# **Conclusion**

The progress of the biology program has exceeded expectations and is continuing to grow at a healthy rate. To provide our dedicated students with the proper tools to succeed in their chosen field there is a need to **hire an additional biology faculty member** before the fall of 2019. To compare, similar sized higher education institutions have multiple full-time faculty: Southern Nazarene Univ. has 3 biology and 2 chemistry professors; Oklahoma Christian Univ. has 3 biology, 3 chemistry and 5 adjunct professors; Oklahoma Baptist Univ. has 5 biology and 5 chemistry professors. I am very appreciative of all the hard work that was accomplished to hire a chemistry professor for the fall of 2018. In accordance with our school motto "*Dream Bigger. Do* Greater." we need to invest in an additional quality faculty member as we continue to grow, and build for the future.

Biology Program Future Outlook By: Harold Kihega, Ph.D.

## Introduction

As of July 21, 2017 the biology program has 28 student majors. According to the original 5-year plan developed in July 2016, the Fall of 2017 would be the first semester to offer courses for biology majors. Since the original plan, the Otoe-Missouria tribe funded MACU \$20,000.00, this funding put the biology department approximately 1 year ahead of schedule. See below (original 5-year plan) **Please note: (develop or update) refers to researching textbooks, creating curriculum, and ordering lab materials**.

## 1<sup>st</sup> Year: 2016-2017

Develop/Update Biology Courses with Laboratories:

- Biology for non-majors with lab (update) Completed

- Biology I for majors with lab (develop) Completed

- Biology II for majors with lab (develop) Offered Spring 18

- Environmental Science for non-majors with lab (develop) Completed

Order books, equipment, and supplies for new courses

# Considerations for 2<sup>nd</sup> Year development:

- General Zoology with lab (develop) Begin Teaching Fall 17

- General Botany with lab (develop)

- Anatomy and Physiology I with lab (develop) Completed

- Anatomy and Physiology II with lab (develop) Begin Teaching Spring 18

Search for external supplemental funding opportunities for lab equipment: Anatomy and Physiology I and II, Botany, and Zoology. <u>Otoe-Missouria Tribe funding has put this</u> <u>section ahead of schedule</u>

Establish proper disposal protocol for dissected specimens and chemicals. <u>This still</u> needs to be completed via Maintenance Department

# 2<sup>nd</sup> Year: 2017-2018

Develop Biology Courses with Laboratories: <u>Otoe-Missouria Tribe funding has moved</u> this development section ahead of schedule.

- General Zoology with lab (develop) Begin Teaching Fall 17

- General Botany with lab (develop) Possible addition to Spring 18

- Anatomy and Physiology I with lab (develop) Completed

- Anatomy and Physiology II with lab (develop) <u>Begin Teaching Spring 18</u> Order books, equipment, and supplies for new courses

Considerations for 3<sup>rd</sup> Year development: <u>The section below will also move ahead of</u> <u>schedule pending funds.</u>

- Human Physiology with lab (develop)

- Microbiology with lab (develop)

- Genetics with lab (develop)

## Needs

With the 2016 projection of incoming freshmen majoring in biology it was feasible to project chemistry and microbiology lab development for the Fall 2019 semester. However, there are many MACU students who either changed their major to biology or transferred to MACU (mostly athletes) seeking a biology degree. These students have already completed the majority of their general education courses and are ready for upper division coursework, as well as enrolling in chemistry and microbiology courses.

## Ideas and Opportunities

In the near future, the needs at MACU will be a chemistry and microbiology lab. The MACU Biology Department Chair is currently working with the Key Account Manager - Becky Kriewall at VWR International LLC. to establish a budget for both chemistry and microbiology supplies. He is also working with the regional director of VWR - Brian Blackstock on furniture supplies for 2 lab rooms. This conversation is ongoing as of July 21, 2017.

On July 21, 2017 the MACU Biology Department Chair will have a 2<sup>nd</sup> lunch meeting with Dr. Steven Shore, who is the senior chemistry professor at Oklahoma City Community College. During this meeting we will discuss the following items:

What is the possibility of a partnership with MACU to use the Chemistry Lab at OCCC?

When would the lab be available to MACU students if OCCC agrees to partner? How much would OCCC charge MACU for use of the Chemistry lab <u>OR</u> the possibility of an alternative plan of MACU stocking the lab instead? Would there be any additional expenses passed onto MACU students, for example, parking permits, student ID badges, etc.?

If OCCC would be willing to let MACU teach labs at their campus, we will still need to find a qualified instructor in the field of chemistry.

The week of August 7, 2017 the MACU Biology Department Chair will have a meeting with Dr. Fabiola Janaik-Spens, who was recently the lead professor in biotechnology at OCCC. She has just accepted a full-time position at Westmoore high school. It is my understanding that prior to OCCC closing their biotechnology program, Dr. Janiak-Spens had a partnership with the University of Oklahoma's medical school. The medical school sent their students to OCCC to learn the latest laboratory techniques in biotechnology. It would be a great opportunity for MACU to consider offering Dr. Janaik-Spens a consultant role for chemistry lab development, which could possibly lead to adjunct teaching opportunities.

In the near future, MACU should consider adding additional faculty in the area of biology and chemistry (each with expertise in their field e.g. molecular v. organismal). As a comparative example for full-time faculty: Southern Nazarene Univ. has 3 biology and 2 chemistry professors; Oklahoma Christian Univ. has 3 biology, 3 chemistry and 5 adjunct professors; Oklahoma Baptist Univ. has 5 biology and 5 chemistry professors. To be our best, we need to invest in quality faculty members as we continue to grow and build for the future.

## 2017 Biology Report and Direction

Over the past 6 months the Biology Program at Mid American Christian University (MACU) has made incredible progress. During the fall semester of 2016 we acquired funding from the Otoe-Missouria Tribe of Oklahoma (OMTO), this unexpected funding set the development of biology courses ahead of schedule. In return for their (OMTO) investment, MACU will provide a 3-day STEM camp during the month of May. This will serve the OMTO youth by exposing data collection methods, as well as a recruitment tool for MACU.

Over the last few months there has been an increase of interests for students both on and off the MACU campus. Currently, we have 12 students enrolled in Biology I for majors, and 11 students enrolled in Anatomy and Physiology I, which is also a major course. During the Christmas break Dr. Kihega met with two basketball recruits who were interested in the biology program at MACU. According to the Recruitment Office at MACU, 361 contacts for the fall 2017 semester indicated interest in majoring in medicine, physical therapy, pharmacy, chemistry, athletic training, and sports medicine, all which require biology courses to complete.

Currently, Dr. Fowlkes and Dr. Kihega are sponsoring a MACU STEM Club with 16 members. On January 27<sup>th</sup>, 2017 the STEM club will be visiting the History of Science museum at the University of Oklahoma (OU). Eventually, it will be a goal of our Math and Science department to establish a bridge program to OU and Oklahoma State University for MACU graduates planning on attending professional, or graduate degree programs. Additionally, the school of Math and Science is continuing to equip the biology labs with approximately \$9,000.00 spent thus far, strategically the majority of money is being spent on non-consumables. As an example, both biology labs (Kennedy Hall and Main Building) are equipped with quality microscopes. In fact, a valuable rapport has grown between MACU and Ward's Scientific, which recently resulted in a \$2844.00 savings in a recent order.

As the biology program continues to grow, certain aspects will become the focus of the department. One aspect in particular will be pursuing funds through grants. It is the ambition of Dr. Fowlkes and Dr. Kihega to determine and apply for eligible grants that may assist MACU with costs associated of a growing biology program. Our department's goal is to have a functional microbiology and chemistry lab for our biology majors by the fall of 2019, if not sooner. Having a microbiology and chemistry lab would solidify MACU's commitment to provide excellence in education to those currently majoring in biology and freshman who will be committing to MACU as soon as the fall of 2017.

Sincerely,

Harold Kihega, Ph.D.

Carol Fowlkes, Ph.D.

# **Chemistry and Microbiology Lab Costs**

According to the questions asked during a recent phone conversation with the Regional Director at VWR, the following items should be considered:

- 1. Renovations of existing buildings are usually more cost effective.
- 2. If a new building is built in the future, VWR can relocate equipment to the new lab rooms.
- 3. Not finishing the ceiling (exposed lights etc.) is becoming the trend in order to cut costs.
- 4. Flooring can be left as exposed concrete with a staining technique to cut costs.
- 5. Reconnecting to existing plumbing is often more cost effective.
- 6. There is no cost for MACU for a site visit from VWR.

# The total maximum cost for supplying labs would be ~ \$452,188.00 (see below)

The following are estimated costs for a Chemistry lab room:

# Supplier: Sargent Welch

# **Approximate Class Size = 30 Students**

(In my opinion labs should be capped at 20 students.)

# Costs for Supplies and Chemicals = \$182,260.00 (see attachment in email)

(Please note this is the maximum cost, smaller classroom sizes and omitted unnecessary equipment will lower the price.)

# **Supplier: VWR International**

# Approximate Room Size Quoted = 30'x40'

# **Cost for Equipping Lab with Furnishings = \$111,500.00**

(Please note the lab room size quoted may be larger than what MACU requires, therefore the cost may be lower than quoted.)

The following are estimated costs for a **Microbiology lab room**:

# Supplier: Wards Science

# **Approximate Class Size: 32 Students**

(In my opinion labs should be capped at 20 students.)

Costs for Supplies = \$158,128.00 (see attachment in email)

(Please note this is the maximum cost, smaller classroom sizes and omitted unnecessary equipment will lower the price. Also, the accounts manager said she would discount materials.)

# Supplier: VWR International (Assumption that the cost is similar to Chemistry lab) Approximate Room Size Quoted = 30'x40'

Cost for Equipping Lab with Furnishings = \$111,800.00 (we can deduct costs for some supplies such as Fume Hoods)

(Please note the lab room size quoted may be larger than what MACU requires, therefore the cost may be lower than the VWR quote.)

## MACU In-House Proposal

Building a relationship with the Otoe-Missouria tribe has been especially successful for MACU. Their previous donation has allowed MACU to offer more courses in the biological sciences than originally anticipated. Currently, there are 15 declared biology majors on campus. According to the MACU recruitment department approximately 12 incoming freshmen will be majoring in biology, which brings the total MACU biology majors to 27.

Recently, the OM tribe has shown interest in helping MACU build a lab. This donation would enhance the biology degree program by allowing students to stay on campus for their required chemistry courses. In lieu of their donation they suggested scholarships for 10 students over a 10-year time frame.

## **Rationale**

Biology is an integral part of any higher education institution. As an example: Northern Oklahoma College (NOC 2yr-college), which is comparable in student population size, has shared the following data for the 2017 spring semester. Biology related fields had the highest percentage of majors (the next highest major is Business Administration at 12.8%).

Declared Major	No. of Students	% of All Majors
Pre-medicine	168	6%
Pre-pharmacy	14	0.5%
Biology/Zoology	75	2.8%
Chemistry	5	0.2%
Nursing Pre-BSN	100	3.7%
Nursing Pre-NOC nursing	184	6.8%
Totals	378	14%

While chemistry has the lowest number of majors at NOC, all the majors listed above require chemistry courses with a lab. In fact, according to NOC, the total number of students enrolled in chemistry courses (on all campus sites) for Spring 2017 is 386 students. Projecting the economic benefit at MACU by using only 25% of the 378 declared majors (95 students) from NOC data the monetary impact is as follows:

\$690/credit hour x 12-17 hours/semester = \$8,280 x 95 students = \$786,600 per semester

\$786,600 x 2 semesters = \$1,573,200 per academic year x 4 years (to earn a BS) = \$6,292,800

The Math and Science Department anticipates growing 20% after the initial 2016-17 semesters.

MACU Projections	Freshmen 20% Increase	Total Biology Majors
2016-17 Current Majors	15	15
2017-18	20	35
2018-19	24	59
2019-20	29	88 (15 graduate)
2020-21	35	107
2021-22	41	114

The benefits that may arise from our relationship with the Otoe-Missouria Tribe are as follows:

- 1. Collaborations with the Otoe-Missouria tribe will serve as a model for developing relationships with other tribes in Oklahoma
- 2. Increasing the minority population will help us reach the threshold of having a 50% minority population, consequently MACU becomes a Minority-Serving Institution
- 3. The relationship with the Otoe-Missouria tribe may enhance our abilities to acquire NSF grants, through a Letter of Support and by serving underrepresented groups in STEM
- 4. Friends and family may follow Otoe-Missouria students to MACU thereby increasing the student population on campus
- 5. Many Otoe-Missouria students attend NOC, MACU can build a bridge program with NOC students who are working towards STEM related degrees
- 6. Open avenues for adult Otoe-Missouria tribal members to continue education through MACU CAGS program
- 7. Otoe-Missouria students are often involved in athletics via Frontier High School including basketball, baseball, and softball which may enhance the athletic teams at MACU
- 8. Having chemistry labs on campus will solidify MACU's commitment to the current students enrolled in the biology program
- 9. MACU chooses who teaches chemistry (science) to our students
- 10. Future funding opportunities to extend the Otoe-Missouria high school STEM camp
- 11. A common theme with NSF grants is to increase the number of underrepresented groups majoring in STEM fields, the joint effort with the Otoe-Missouria tribe fulfills that mission

# **Conclusion**

The Math and Science department humbly requests that we offer the Otoe-Missouria tribe the best possible agreement, not only to secure funding, but also to set a relationship standard for other Oklahoma tribes to follow as new opportunities arise at MACU.

Harold Kihega, Ph.D.

Carol Fowlkes, Ph.D.

Dear Esther,

Below is an excerpt from the Math and Science 5 year plan, which was developed in 2016.

4<sup>th</sup> Year: 2019-2020 (This may move to year 3 due to OM funding)
 Current and new Biology/Chemistry Faculty develops/updates Biology courses:
 - Human Anatomy with lab (update/develop) Summer 19

- Cell biology with lab (update/develop) Fall 19 or Spring 20

- Evolution (update/develop) Fall 19 or Spring 20

- Biology Seminar/Journal Club (develop) Fall 19 and Spring 20

Order books, equipment, and supplies for new courses Continue searching and applying for supplemental external funding Continue development of Chemistry Department Begin teaching Microbiology with lab, Genetics with lab, and Human Physiology with lab on MACU campus

Begin teaching Chemistry I and II with labs on MACU campus

We are requesting an update for the lab room(s) on campus. Accordingly there are 2 different options for new lab space: Option 1 - Redo rooms KH110 and KH111 Option 2 - Redo room CR137.

After speaking with Dr. Fernando the following are reasons we prefer Option 1. 1. Central area for a lab assistant and preparation of chemicals and various reagents used for various Biology, Microbiology, and Chemistry labs.

2. Sharing of equipment between, Biology, Microbiology, and Chemistry Labs e.g. hot plates, stirrers, glassware, spectrophotometers, reagents, chemicals, and pH meters etc.

3. Central location will also prevent and hazardous materials, or expensive equipment from being transported from building to building.

4. More storage area for shared equipment.

5. Gain two useable lab spaces for a total of three labs on campus instead of two labs.

6. With the table setup on the floor plan (VWR) we will also gain an additional classroom space for science courses in KH110. (Lab assistant will be able to set up and break down lab exams as needed)

Sincerely,

Destani Fernando, Ph.D. Associate Professor of Chemistry

Harold Kihega, Ph.D. Chair and Associate Professor of Biology

Program Review Evaluation Biology, B.S., spring 2021

Program Director and School Chair: Harold Kihega, Ph.D.

Signature

date signed 01/14/2021

Director of Institutional Effectiveness: Ray Dillman, M.A.

Signature

date signed 1, 21, 2021

Program Dean: Esther Rehbein, M.Ed.

other Kehlens Signature

Vice-President of Academic Affairs, Sharon Lease, Ph.D.

Baren Besse Signature

1. 24.71 date signed

date signed 1-24- 2021