

COVER SHEET FOR PROPOSAL TO THE NATIONAL SCIENCE FOUNDATION

PROGRAM ANNOUNCEMENT/SOLICITATION NO./DUE DATE NSF 16-540 05/16/16		<input type="checkbox"/> Special Exception to Deadline Date Policy		FOR NSF USE ONLY	
FOR CONSIDERATION BY NSF ORGANIZATION UNIT(S) (Indicate the most specific unit known, i.e. program, division, etc.) DUE - S-STEM: SCHLR SCI TECH ENG&MATH				NSF PROPOSAL NUMBER 1643549	
DATE RECEIVED	NUMBER OF COPIES	DIVISION ASSIGNED	FUND CODE	DUNS# (Data Universal Numbering System)	FILE LOCATION
05/13/2016	1	11040000 DUE	1536	067954685	05/13/2016 7:56pm
EMPLOYER IDENTIFICATION NUMBER (EIN) OR TAXPAYER IDENTIFICATION NUMBER (TIN) [REDACTED]		SHOW PREVIOUS AWARD NO. IF THIS IS <input type="checkbox"/> A RENEWAL <input type="checkbox"/> AN ACCOMPLISHMENT-BASED RENEWAL		IS THIS PROPOSAL BEING SUBMITTED TO ANOTHER FEDERAL AGENCY? YES <input type="checkbox"/> NO <input checked="" type="checkbox"/> IF YES, LIST ACRONYM(S)	
NAME OF ORGANIZATION TO WHICH AWARD SHOULD BE MADE Avila University			ADDRESS OF AWARDEE ORGANIZATION, INCLUDING 9 DIGIT ZIP CODE Avila University 11901 Wornall Road Kansas City, MO. 641451698		
AWARDEE ORGANIZATION CODE (F KNOWN) 0024497000					
NAME OF PRIMARY PLACE OF PERF Avila University			ADDRESS OF PRIMARY PLACE OF PERF, INCLUDING 9 DIGIT ZIP CODE Avila University 11901 Wornall Road Kansas City ,MO ,641451007 ,US.		
IS AWARDEE ORGANIZATION (Check All That Apply) (See GPG II.C For Definitions)		<input type="checkbox"/> SMALL BUSINESS	<input type="checkbox"/> MINORITY BUSINESS	<input type="checkbox"/> IF THIS IS A PRELIMINARY PROPOSAL THEN CHECK HERE	
		<input type="checkbox"/> FOR-PROFIT ORGANIZATION	<input type="checkbox"/> WOMAN-OWNED BUSINESS		
TITLE OF PROPOSED PROJECT Advancing Cohorts of Excellence in STEM (ACES) Program					
REQUESTED AMOUNT \$ 650,000	PROPOSED DURATION (1-60 MONTHS) 60 months	REQUESTED STARTING DATE 10/01/16	SHOW RELATED PRELIMINARY PROPOSAL NO. IF APPLICABLE		
THIS PROPOSAL INCLUDES ANY OF THE ITEMS LISTED BELOW					
<input type="checkbox"/> BEGINNING INVESTIGATOR (GPG I.G.2)		<input type="checkbox"/> HUMAN SUBJECTS (GPG II.D.7) Human Subjects Assurance Number _____ Exemption Subsection _____ or IRB App. Date _____			
<input type="checkbox"/> DISCLOSURE OF LOBBYING ACTIVITIES (GPG II.C.1.e)		<input type="checkbox"/> INTERNATIONAL ACTIVITIES: COUNTRY/COUNTRIES INVOLVED (GPG II.C.2.j)			
<input type="checkbox"/> PROPRIETARY & PRIVILEGED INFORMATION (GPG I.D, II.C.1.d)					
<input type="checkbox"/> HISTORIC PLACES (GPG II.C.2.j)					
<input type="checkbox"/> VERTEBRATE ANIMALS (GPG II.D.6) IACUC App. Date _____ PHS Animal Welfare Assurance Number _____		<input checked="" type="checkbox"/> COLLABORATIVE STATUS Not a collaborative proposal			
<input checked="" type="checkbox"/> FUNDING MECHANISM Research - other than RAPID or EAGER					
PI/PD DEPARTMENT Biology		PI/PD POSTAL ADDRESS 11901 Wornall Road			
PI/PD FAX NUMBER 816-501-2457		Kansas City, MO 64145			
		United States			
NAMES (TYPED)	High Degree	Yr of Degree	Telephone Number	Email Address	
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CERTIFICATION PAGE**Certification for Authorized Organizational Representative (or Equivalent) or Individual Applicant**

By electronically signing and submitting this proposal, the Authorized Organizational Representative (AOR) or Individual Applicant is: (1) certifying that statements made herein are true and complete to the best of his/her knowledge; and (2) agreeing to accept the obligation to comply with NSF award terms and conditions if an award is made as a result of this application. Further, the applicant is hereby providing certifications regarding conflict of interest (when applicable), drug-free workplace, debarment and suspension, lobbying activities (see below), nondiscrimination, flood hazard insurance (when applicable), responsible conduct of research, organizational support, Federal tax obligations, unpaid Federal tax liability, and criminal convictions as set forth in the NSF Proposal & Award Policies & Procedures Guide, Part I: the Grant Proposal Guide (GPG). Willful provision of false information in this application and its supporting documents or in reports required under an ensuing award is a criminal offense (U.S. Code, Title 18, Section 1001).

Certification Regarding Conflict of Interest

The AOR is required to complete certifications stating that the organization has implemented and is enforcing a written policy on conflicts of interest (COI), consistent with the provisions of AAG Chapter IV.A.; that, to the best of his/her knowledge, all financial disclosures required by the conflict of interest policy were made; and that conflicts of interest, if any, were, or prior to the organization's expenditure of any funds under the award, will be, satisfactorily managed, reduced or eliminated in accordance with the organization's conflict of interest policy. Conflicts that cannot be satisfactorily managed, reduced or eliminated and research that proceeds without the imposition of conditions or restrictions when a conflict of interest exists, must be disclosed to NSF via use of the Notifications and Requests Module in FastLane.

Drug Free Work Place Certification

By electronically signing the Certification Pages, the Authorized Organizational Representative (or equivalent), is providing the Drug Free Work Place Certification contained in Exhibit II-3 of the Grant Proposal Guide.

Debarment and Suspension Certification (If answer "yes", please provide explanation.)

Is the organization or its principals presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from covered transactions by any Federal department or agency? Yes No

By electronically signing the Certification Pages, the Authorized Organizational Representative (or equivalent) or Individual Applicant is providing the Debarment and Suspension Certification contained in Exhibit II-4 of the Grant Proposal Guide.

Certification Regarding Lobbying

This certification is required for an award of a Federal contract, grant, or cooperative agreement exceeding \$100,000 and for an award of a Federal loan or a commitment providing for the United States to insure or guarantee a loan exceeding \$150,000.

Certification for Contracts, Grants, Loans and Cooperative Agreements

The undersigned certifies, to the best of his or her knowledge and belief, that:

- (1) No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.
- (2) If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with his Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form-LLL, "Disclosure of Lobbying Activities," in accordance with its instructions.
- (3) The undersigned shall require that the language of this certification be included in the award documents for all subawards at all tiers including subcontracts, subgrants, and contracts under grants, loans, and cooperative agreements and that all subrecipients shall certify and disclose accordingly.

This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by section 1352, Title 31, U.S. Code. Any person who fails to file the required certification shall be subject to a civil penalty of not less than \$10,000 and not more than \$100,000 for each such failure.

Certification Regarding Nondiscrimination

By electronically signing the Certification Pages, the Authorized Organizational Representative (or equivalent) is providing the Certification Regarding Nondiscrimination contained in Exhibit II-6 of the Grant Proposal Guide.

Certification Regarding Flood Hazard Insurance

Two sections of the National Flood Insurance Act of 1968 (42 USC §4012a and §4106) bar Federal agencies from giving financial assistance for acquisition or construction purposes in any area identified by the Federal Emergency Management Agency (FEMA) as having special flood hazards unless the:

- (1) community in which that area is located participates in the national flood insurance program; and
- (2) building (and any related equipment) is covered by adequate flood insurance.

By electronically signing the Certification Pages, the Authorized Organizational Representative (or equivalent) or Individual Applicant located in FEMA-designated special flood hazard areas is certifying that adequate flood insurance has been or will be obtained in the following situations:

- (1) for NSF grants for the construction of a building or facility, regardless of the dollar amount of the grant; and
- (2) for other NSF grants when more than \$25,000 has been budgeted in the proposal for repair, alteration or improvement (construction) of a building or facility.

Certification Regarding Responsible Conduct of Research (RCR)

(This certification is not applicable to proposals for conferences, symposia, and workshops.)

By electronically signing the Certification Pages, the Authorized Organizational Representative is certifying that, in accordance with the NSF Proposal & Award Policies & Procedures Guide, Part II, Award & Administration Guide (AAG) Chapter IV.B., the institution has a plan in place to provide appropriate training and oversight in the responsible and ethical conduct of research to undergraduates, graduate students and postdoctoral researchers who will be supported by NSF to conduct research. The AOR shall require that the language of this certification be included in any award documents for all subawards at all tiers.

CERTIFICATION PAGE - CONTINUED

Certification Regarding Organizational Support

By electronically signing the Certification Pages, the Authorized Organizational Representative (or equivalent) is certifying that there is organizational support for the proposal as required by Section 526 of the America COMPETES Reauthorization Act of 2010. This support extends to the portion of the proposal developed to satisfy the Broader Impacts Review Criterion as well as the Intellectual Merit Review Criterion, and any additional review criteria specified in the solicitation. Organizational support will be made available, as described in the proposal, in order to address the broader impacts and intellectual merit activities to be undertaken.

Certification Regarding Federal Tax Obligations

When the proposal exceeds \$5,000,000, the Authorized Organizational Representative (or equivalent) is required to complete the following certification regarding Federal tax obligations.

By electronically signing the Certification pages, the Authorized Organizational Representative is certifying that, to the best of their knowledge and belief, the proposing organization:

- (1) has filed all Federal tax returns required during the three years preceding this certification;
- (2) has not been convicted of a criminal offense under the Internal Revenue Code of 1986; and
- (3) has not, more than 90 days prior to this certification, been notified of any unpaid Federal tax assessment for which the liability remains unsatisfied, unless the assessment is the subject of an installment agreement or offer in compromise that has been approved by the Internal Revenue Service and is not in default, or the assessment is the subject of a non-frivolous administrative or judicial proceeding.

Certification Regarding Unpaid Federal Tax Liability

When the proposing organization is a corporation, the Authorized Organizational Representative (or equivalent) is required to complete the following certification regarding Federal Tax Liability:

By electronically signing the Certification Pages, the Authorized Organizational Representative (or equivalent) is certifying that the corporation has no unpaid Federal tax liability that has been assessed, for which all judicial and administrative remedies have been exhausted or lapsed, and that is not being paid in a timely manner pursuant to an agreement with the authority responsible for collecting the tax liability.

Certification Regarding Criminal Convictions

When the proposing organization is a corporation, the Authorized Organizational Representative (or equivalent) is required to complete the following certification regarding Criminal Convictions:

By electronically signing the Certification Pages, the Authorized Organizational Representative (or equivalent) is certifying that the corporation has not been convicted of a felony criminal violation under any Federal law within the 24 months preceding the date on which the certification is signed.

Certification Dual Use Research of Concern

By electronically signing the certification pages, the Authorized Organizational Representative is certifying that the organization will be or is in compliance with all aspects of the United States Government Policy for Institutional Oversight of Life Sciences Dual Use Research of Concern.

AUTHORIZED ORGANIZATIONAL REPRESENTATIVE		SIGNATURE	DATE
NAME Deanna Nelson		Electronic Signature	May 13 2016 3:36PM
TELEPHONE NUMBER 816-501-2435	EMAIL ADDRESS deanna.nelson@avila.edu	FAX NUMBER	

NATIONAL SCIENCE FOUNDATION
Division of Undergraduate Education

NSF FORM 1295: PROJECT DATA FORM

The instructions and codes to be used in completing this form are provided in Appendix II.

1. Program-track to which the Proposal is submitted: S-STEM:SCHLR SCI TECH ENG&MATH
2. Name of Principal Investigator/Project Director (as shown on the Cover Sheet):
Powell, Robert
3. Name of submitting Institution (as shown on Cover Sheet):
Avila University
4. Other Institutions involved in the project's operation:

Project Data:

- A. Major Discipline Code: 99
- B. Academic Focus Level of Project: BO
- C. Highest Degree Code: B
- D. Category Code: --
- E. Business/Industry Participation Code: NA
- F. Audience Code: _____
- G. Institution Code: PRIV
- H. Strategic Area Code: _____
- I. Project Features: 1 2 3 4 5

Estimated number in each of the following categories to be directly affected by the activities of the project during its operation:

- J. Undergraduate Students: 220
- K. Pre-college Students: 0
- L. College Faculty: 7
- M. Pre-college Teachers: 0
- N. Graduate Students: 0

PROJECT SUMMARY

Overview:

Avila University's proposed Advancing Cohorts of Excellence in STEM (ACES) Program will build on institution-wide efforts to increase retention and 4-year graduation rates and address the Kansas City region's need for high-qualified life and computer scientists. S-STEM recruitment will include targeted print and digital marketing, presentations at more than 300 regional high schools (many of which serve low-income and minority students), and S-STEM booths at campus and community events, including events targeting students from groups underrepresented in STEM. The selection process will assess academic merit, financial need, potential to excel in the program, and potential to succeed in STEM careers and graduate programs. Support services will include a cohort model; a Living/Learning Community; common coursework; redesigned courses and sequences; faculty, peer, and professional mentorships; career development workshops; early-alert retention support; supplemental instruction; and STEM seminars. The program will improve data analytics by creating a STEM Student Success Dashboard, which will facilitate monitoring and analysis of on-track indicators by discipline, student subgroup, and dosage of support services.

The program will accomplish five objectives: Objective 1: a) enroll 16 scholars in Avila's biology, biochemistry and molecular biology, computer science, or software engineering program and b) increase enrollment in these majors by 20%; Objective 2: enhance support services for scholars and low-income STEM students to ensure that 93% of scholars are retained from freshman to sophomore year and 81% of scholars graduate within four years and to increase the first-year retention rate of S-STEM disciplines to 83% and the 4-year graduation rate of S-STEM disciplines to 58%; Objective 3: provide early engagement in research, early exposure to STEM careers, and enhanced career services to improve STEM career readiness and ensure 85% of scholars secure STEM employment or enter a STEM graduate program within one year of graduation; Objective 4: increase Avila's capacity to collect and analyze student data to effectively diagnose STEM student needs and assess the impact of supportive curricular and co-curricular activities on STEM student success; Objective 5: develop, formally adopt, and implement a plan to sustain S-STEM activities that evaluation results demonstrate to be effective in low-income STEM student recruitment, retention to graduation, and preparedness to enter the STEM workforce or graduate programs.

Intellectual Merit :

The program will increase the number of low-income students who participate in STEM degree programs that employ evidence-based, high-impact educational practices, such as course sequences that provide early engagement in research and early exposure to STEM careers, transition-to-university programming, internships, and project-based capstone courses. It will enhance support services, such as faculty, peer, and professional mentorships; supplemental instruction; and STEM seminars. It will also improve Avila's capabilities to collect, analyze, and report on factors impacting STEM student success. Improved data analytics will facilitate program evaluation, and the research study and dissemination efforts will advance knowledge regarding what works to improve educational outcomes for low-income STEM students. Lastly, the program will be implemented by highly qualified faculty, and the Leadership Team will include representation from all offices providing student support and Avila administrative leadership.

Broader Impacts :

The program will i) build on past and current NSF REU funding and contribute to the mutual goals of NSF, Missouri EPSCoR, and the State of Missouri to increase the number of STEM students engaged in undergraduate research and provided with opportunities to publish research and present at professional STEM conferences; ii) increase the number of STEM graduates from traditionally underrepresented populations and strengthen the pipeline of qualified scientists entering STEM positions of high demand, improving U.S. economic competitiveness; iii) enhance partnerships between STEM programs and STEM industries, connecting scholars with professional mentors and hands-on internships in industry; and iv) broadly disseminate research findings through publications and presentations to build the body of research on best practices in the scholarship of STEM teaching and learning.

TABLE OF CONTENTS

For font size and page formatting specifications, see GPG section II.B.2.

	Total No. of Pages	Page No.* (Optional)*
Cover Sheet for Proposal to the National Science Foundation		
Project Summary (not to exceed 1 page)	1	_____
Table of Contents	1	_____
Project Description (Including Results from Prior NSF Support) (not to exceed 15 pages) (Exceed only if allowed by a specific program announcement/solicitation or if approved in advance by the appropriate NSF Assistant Director or designee)	15	_____
References Cited	5	_____
Biographical Sketches (Not to exceed 2 pages each)	9	_____
Budget (Plus up to 3 pages of budget justification)	9	_____
Current and Pending Support	5	_____
Facilities, Equipment and Other Resources	3	_____
Special Information/Supplementary Documents (Data Management Plan, Mentoring Plan and Other Supplementary Documents)	3	_____
Appendix (List below.) (Include only if allowed by a specific program announcement/ solicitation or if approved in advance by the appropriate NSF Assistant Director or designee)	_____	_____
Appendix Items:		

*Proposers may select any numbering mechanism for the proposal. The entire proposal however, must be paginated. Complete both columns only if the proposal is numbered consecutively.

A. Results from Prior NSF Support

Since 1991, Avila University has implemented 11 NSF Research Experience for Undergraduates (REU) grants, providing more than 100 STEM students from 68 institutions of higher education with meaningful research opportunities that led to publications in peer-reviewed journals. S-STEM PI Dr. Robert Powell has served as investigator on three NSF REU grants within the past five years, including as PI on an REU site project titled “Natural History of a West Indian Herpetofauna”—Award Number: 0851610; Amount: \$255,417; Period of Support: 7/2009–6/2013.

Intellectual merit: The project provided nine undergraduates and four faculty per year with hands-on, international research experiences studying the difficulties of conserving natural resources on Union Island, St. Vincent and the Grenadines (SVG), and Eleuthera Island, Commonwealth of the Bahamas. Studies addressed subjects such as the adventitious scavenging of arthropod carcasses by Cuban tree frog tadpoles, water loss rates in diminutive dwarf geckos, and correlations in curly-tailed lizards between laboratory performance criteria and behaviors in nature. Subsequent to the fieldwork, all students analyzed results with faculty guidance and coauthored at least one paper published in a peer-reviewed journal (see References Cited for publications resulting from the award). In addition to presentations in the course of each program and at each student’s home institution, many students presented research results at national, regional, and state meetings of various professional societies.

Broader impacts: The project successfully recruited students from groups underrepresented in STEM and students from institutions that provide limited research. All participants experienced the entire research process, beginning with observations leading to questions and hypothesis development and culminating with publication. Students worked in the field with personnel from the SVG Department of Forestry to develop a conservation plan for a vital watershed on Union Island that contains the largest intact stand of old secondary forest in the Grenadines. Students also worked with local NGOs to promote conservation awareness on Union Island by developing educational materials for use in primary and secondary schools. Students developed instructional tools and provided school officials and NGOs with these tools. Publication copies were presented to the SVG Department of Forestry and Union Island NGOs or the Cape Eleuthera Institute, Bahamas National Trust, and Bahamas Environment, Science, and Technology Commission. Students also compiled reports of their activities, which were printed in Union Island’s newspaper and in newsletters of Union Island NGOs.

B. Project Objectives and Plans

i. Introduction: Avila University is a values-based community of learning that provides liberal arts, professional, undergraduate, and graduate education to prepare students for responsible lifelong contributions to the global community. Located in Kansas City, Missouri, Avila currently enrolls 1,148 undergraduates. Avila is one of the most diverse universities in the Midwest; 40% of students are minorities. The university’s STEM programs combine rigorous liberal arts course work, career-based activities such as undergraduate research and internships, and service learning to ensure majors emerge with the relational and critical thinking skills, creativity, and knowledge required to succeed in STEM graduate programs and careers. Avila launched a campus-wide Quality Initiative during the 2014–15 academic year with the goal of increasing retention rates among first- and second-year students and 4-year graduation rates. The proposed Advancing Cohorts of Excellence in STEM (ACES) Program will build on the investments and activities of the broader Quality Initiative to increase the number and quality of students entering STEM graduate programs and the workforce.

ii. Local need: According to research presented at the Greater Kansas City Workforce Summit, the region’s “education-to-jobs mismatch is particularly evident in STEM fields,” and computer and life sciences jobs are projected to be two of the four fastest-growing occupations in the region (Cook, 2014). One comprehensive study, *The Midwest Challenge: Matching Jobs with Education in the*

Post-Recession Economy, notes that Kansas and Missouri will need 185,000 additional workers with STEM degrees by 2018 to meet workforce demands (Carnevale & Smith, 2015). While computer and life sciences occupations are projected to lead Missouri job growth (Carnevale & Smith, 2015), the need to increase the computer science and life sciences workforce is most evident in the Kansas City region, where these occupations make up 67% of STEM jobs (RWIN, 2012). Missouri Department of Economic Development long-term occupational employment projections for Kansas City (2012–2022) document high growth rates for numerous jobs targeted by S-STEM disciplines, including CIS managers (19%), CIS research scientists (22%), computer systems analysts (27%), information security analysts (31%), software developers (30%), computer network architects (22%), chemical engineers (15%), biochemists (22%), chemists (10%), and microbiologists (12%).

Kansas City area STEM companies are increasingly concerned about the growing difficulty of finding qualified employees, and many regional business leaders highlight the challenge of hiring a qualified workforce while competing with areas such as Silicon Valley or the Research Triangle (Science Pioneers, n.d.). As a result, STEM businesses have increasingly needed to resort to tapping the H1B worker pool (Stafford, 2012). A panel of STEM industry experts recently addressed these concerns at the Kansas City Regional Workforce Summit, and the panel's key recommendation was to increase the number of highly qualified *homegrown* applicants who graduate from regional institutions and enter the regional workforce (Stafford, 2012). First-generation and low-income students represent two of the largest untapped groups with high potential to meet industry demand for STEM employees (U.S. Department of Labor, 2007). However, as noted by many studies and highlighted in the *Industry Market Trends Career Journal*, without significant financial assistance and support, these students can rarely access postsecondary STEM programs (Butcher, 2013).

At the start of the 2015–16 academic year, Avila's School of Science and Health conducted a needs assessment to determine student and departmental needs related to STEM student retention and workforce entry. Faculty and administrators convened with the Office of Information Management to assess STEM student performance, persistence, points of attrition, and graduate rates; review Avila's university-wide needs assessment and strategic plan (Quality Initiative); survey faculty and staff; and conduct a literature review and roundtable discussions. The results of this assessment documented the need to improve the STEM first-year retention rate, which has declined from 83% to 71% over the past four years, and to improve the STEM 4-year graduation rate, which has fallen below 30%. The School of Science and Health has identified two causative factors that must be addressed to improve these rates. First, STEM students require support in intro STEM courses. The needs assessment found that less than 70% of students passed certain intro STEM courses (e.g., College Algebra, General Biology). Studies have found that many students drop out of STEM programs due to poor performance in intro STEM courses (Ost, 2010; Rask, 2010; Stinebrickner and Stinebrickner, 2011). Avila STEM faculty advisors highlighted students' time management and expectations regarding out-of-class study time as factors contributing to low pass rates. This is especially true among first-generation students. This assessment parallels those of a number of studies finding a strong correlation between time management and academic performance (Tanriogen & Isan, 2009; Misra & McKean, 2000). Secondly, STEM faculty and administrators found that many STEM students drop out due to financial reasons. STEM 4-year graduation rates are directly impacted by students' need to work part-time jobs. Some STEM students, particularly computer science majors, drop out after junior year because they are able to secure computer-related, high-paying jobs. STEM faculty also highlighted that many students lack financial literacy skills, which impacts their ability to graduate on time. This parallels research documenting low financial literacy among college students (Avard et al., 2005; Eitel & Marin, 2009; Thaden & Rookey, 2005) and the strong correlation between financial literacy and college students' academic performance, mental and physical well-being, and ability to find employment after graduation (Bodvarsson & Walker, 2004; Lyons, 2007).

iii. Project objectives: Avila's ACES Program will address the needs outlined above and accomplish five objectives: **Objective 1**: a) enroll 16 academically talented students with financial need in Avila's biology, biochemistry and molecular biology, computer science, or software engineering program and b) increase total enrollment in these majors by 20%; **Objective 2**: enhance student support services for S-STEM scholars and low-income students in S-STEM disciplines to ensure that 93% of S-STEM scholars are retained from freshman to sophomore year and 81% of S-STEM scholars graduate within four years and to increase the first-year retention rate in S-STEM disciplines to 83% and the 4-year graduation rate in S-STEM disciplines to 58%; **Objective 3**: provide early engagement in research, early exposure to STEM careers, and enhanced career services to improve S-STEM scholar career readiness and ensure 85% of scholars secure STEM employment or enter a STEM graduate program within one year of graduation; **Objective 4**: increase Avila's capacity to collect and analyze student data in order to effectively diagnose STEM student needs and assess the impact of supportive curricular and co-curricular activities on STEM student success; and **Objective 5**: develop, formally adopt, and implement a plan to sustain S-STEM activities that evaluation results demonstrate to be effective in low-income STEM student recruitment, retention to graduation, and preparation for entrance in the STEM workforce or graduate programs.

iv. Student selection plan: Student selection plans are outlined in Section F.

v. Implementation/investigation of high-quality extant curriculum and activities: Section D describes high-quality extant curriculum and activities; Sections J and K describe investigation of activities.

vi. Intellectual merit and broader impacts: The program will have **intellectual merit**. It will increase the number of low-income students in STEM programs that employ evidence-based, high-impact practices, such as course sequences with early engagement in research and early exposure to STEM careers, transition-to-university programming, internships, and project-based capstone courses. The program will enhance support services, such as faculty, peer, and professional mentorships; a STEM Learning/Living Community; supplemental instruction; and STEM seminars. It will improve Avila's capacity to collect, analyze, and report on factors impacting STEM student success, enabling faculty to better understand which milestones STEM students struggle to reach, which student subgroups struggle most to reach each milestone, and why students are not reaching milestones. Improved data analytics will facilitate program evaluation, and the research study will advance knowledge regarding what works to improve low-income STEM student outcomes. The program will be implemented by highly qualified faculty who hold the highest degrees in their fields and/or have extensive STEM industry experience, and the Leadership Team will include representation from Avila leadership and all offices providing student support. The program will have **broader impacts**. It will i) build on past and current NSF REU funding and contribute to the mutual goals of NSF, Missouri EPSCoR, and the State of Missouri to increase the number of STEM students engaged in undergraduate research and provided with opportunities to publish research and present at STEM conferences; ii) increase the number of STEM graduates from traditionally underrepresented populations (e.g., first-generation and low-income students) and strengthen the pipeline of highly qualified scientists entering STEM positions of high demand, improving U.S. economic competitiveness; iii) enhance partnerships between Avila STEM programs and STEM industries, connecting STEM students with professional mentors and hands-on internships in local industries; and iv) broadly and strategically disseminate research findings through publications and presentations in order to build the body of research on best practices in the scholarship of STEM teaching and learning.

C. Significance of Project and Rationale

i. Project to meet S-STEM goals: ACES Program objectives and activities align with S-STEM goals. Objectives 1, 2, and 3 address NSF S-STEM Goal 1—"To increase recruitment, retention, success, and graduation of low-income, academically talented STEM students." The program's recruitment

plan will ensure Avila enrolls 16 S-STEM scholars and increases enrollment in S-STEM disciplines by at least 20%. The evidence-based curricular and co-curricular activities described in Section D are designed to increase retention and graduation rates among low-income STEM students.

Objectives 2, 3, and 4 address NSF S-STEM Goal 2—“To implement and study models, effective practices, and/or strategies that contribute to understanding the factors of supportive curricular and co-curricular activities for low-income, academically talented STEM students.” The program will implement a menu of research-based practices and enhance Avila’s efforts to improve data analytics capabilities by creating a STEM Student Success Dashboard that will identify factors contributing to student success and provide the evaluator and researcher with data required to measure the impact of proposed strategies on STEM student success.

Objectives 2 and 5 address NSF S-STEM Goal 3—“To contribute to the implementation and sustainability of effective curricular and co-curricular activities for low-income, academically talented STEM students.” Avila’s executive leadership will serve on the Leadership Team and develop plans for the institutionalization and sustainability of S-STEM strategies that evaluation reports and research studies demonstrate to have a positive impact on STEM student recruitment, retention, graduation, and preparation for STEM graduate programs and careers.

ii. Demographic, enrollment, retention, and graduation data: Table 1 outlines demographic, enrollment, retention, and graduation data for traditional undergraduates and STEM students.

Table 1: Demographic, Enrollment, Retention, and Graduation Data					
	Avila	Biology	BMB*	Computer Science	Software Engineering
Total Student Population	1,148	46	10	32	43
Total Graduated	197	6	N/A	7	1
4-Year Graduation Rate***	29%	22%	N/A	14%****	N/A**
1-Year Retention Rate***	71%	85%	N/A	76%	100%
Male	499 (43%)	20	5	29	41
Female	649 (57%)	26	5	3	2
African-American	160 (14%)	3	0	4	3
Asian/Pacific Islander	18 (2%)	0	0	0	1
Hispanic/Latino	97 (9%)	1	0	0	1
Native American/Alaskan Native	11 (1%)	0	0	1	1
White	691 (60%)	35	9	7	6
Two or more races	39 (3%)	0	0	0	0
Other/Unknown	132 (11%)	7	1	21	31
First-Generation Students	589 (51%)	10 (21%)	1 (10%)	3 (9%)	8 (19%)
Low-Income Students	638 (55%)	16 (35%)	1 (10%)	5 (16%)	5 (12%)

*Biochemistry and molecular biology (BMB) was first offered at the start of the 2015–16 academic year.

**Software engineering was launched in Fall 2012. Therefore, 4-year graduation data are unavailable.

***4-year graduation rates and 1-year retention rates are cumulative averages of the past three student cohorts.

****The CS 4-year graduation rate is 14% because many CS majors stop out for one or two years after completing sophomore or junior year because they can secure high-paying tech jobs due to high local demand.

iii. Expected outcomes: STEM enrollment will increase by at least 20% from 131 to 157 (demographics similar to those in Table 1); the 1-year retention rate will increase from 79% to 83%; and the 4-year graduation rate will increase from 20% to 58%.

iv. Rationale for amount and number of scholarships: The estimated average S-STEM scholarship amount will be \$8,500, with awards ranging from \$6,000 to \$10,000 depending on each S-STEM scholar’s unmet financial need. To determine scholarship amounts, the Selection Committee assessed

unmet financial need among current STEM students, calculated by subtracting students' financial aid package (Pell Grant, FSEOG Grant, Missouri Access Grant, Avila Merit Scholarship, and family contribution) from Avila's cost of attendance. Avila students with a GPA above 3.0 and ACT score above 24 receive an annual merit scholarship of \$12,500 as long as they maintain a 3.0 GPA. As detailed in Table 2, the average unmet financial need among current students is \$4,928/year. However, Avila expects this amount to be higher among S-STEM scholars, as the program will target financially needy students. Providing scholarships ranging from \$6,000 to \$10,000 will enable scholars to focus on their studies instead of work unrelated to their academic programs.

Cost of Attendance	Unmet Need \$0–\$6,000	Unmet Need \$6,001–\$8,000	Unmet Need \$8,001–\$10,000	Unmet Need \$10,001–\$15,000	Average Unmet Need
\$38,582	40 students	7 students	4 students	4 students	\$4,928

The ACES Program will award scholarships to 16 students (two cohorts of 8 scholars). The first cohort will enter in Year 1, and the second cohort will enter in Year 2. Scholars will be eligible for scholarship renewal throughout all four years as long as they meet retention criteria outlined in Table 4 below. The Leadership Team evaluated several factors in determining the appropriate number of S-STEM scholarships. First, enrollment in S-STEM majors has tripled over the past four years, from 43 students to 131 students. Secondly, new S-STEM recruitment efforts will increase the number of students who pursue S-STEM degree programs. Thirdly, the availability of scholarships that relieve financially needy students of the burden associated with pursuing higher education will increase the number of applicants who might otherwise be unable to enter Avila STEM programs.

D. Activities on Which the Current Project Builds

i Enhancement of existing academic and student services: The ACES Program will address needs identified in Section B.ii and build on Avila's Quality Initiative, a campus-wide effort with the goal of increasing the 1-year retention rate to 75% and the 4-year graduation rate to 58%. As part of the Quality Initiative, Avila has invested significant resources to i) establish a mentoring program, ii) implement an early-alert system and effectively monitor student progress, iii) increase the number and quality of academic tutorials, iv) enhance First Year Seminar, and v) increase data analytics capacity. The ACES Program will enhance these efforts by modifying several of the Quality Initiative's research-based strategies to address the needs of low-income STEM students. As detailed in Section I, the research study will conduct a rigorous qualitative investigation of the lived experiences of STEM students. To date, the bulk of peer-reviewed literature exploring S-STEM scholars' reactions has focused on quantitative data such as retention and persistence, which the program evaluation will cover. The proposed qualitative exploration will provide additional data on how the S-STEM support services are experienced in real time and following students' matriculation.

Mentorships: As part of the Quality Initiative, Avila implemented mentoring for first-generation students, and the ACES Program will supplement this program by establishing multitiered mentoring for S-STEM scholars. **Faculty mentorship:** Scholars will be matched with a faculty mentor in their discipline who will meet with scholars biweekly to assist them in i) remaining motivated in their program, ii) achieving academic success, iii) accessing support services, iv) thriving in their cohort, and v) coping positively with the challenges of university life. The PI and Career Advisor will lead a half-day mentor training for faculty mentors, which will include a review of Avila's Mentoring Handbook. Biweekly mentoring will serve as a formal checkpoint to monitor scholar progress, and mentors will document progress and discuss progress reports during Leadership Team meetings. As documented in one NSF-funded study, mentoring has been positively correlated to students' satisfaction with their major, commitment to their major, and involvement in their major (Holland,

Major, & Orvis, 2012). Through this enhancement, scholars will experience a personalized, supportive environment starting in freshman year, which research has demonstrated to increase STEM student retention (O'Neal et al., 2007). **Peer Mentorships:** In their first and second years, scholars will be paired with upper-division STEM students to strengthen personal connections to campus and help them acclimate to campus life. Peer mentors can effectively promote students' sense of belonging and academic capability in their early college years (Packard, 2011). The PI and a Career Advisor will deliver training to peer mentors, oversee the match, and provide ongoing support. **Professional Mentorships:** The Office of Alumni Relations will match scholars with alumni mentors working in STEM professions to strengthen scholars' career preparation, establish access to professional networks, and create a bridge to postgraduate employment (see attached industry partner letters committing to provide professional mentors). Scholars will meet with professional mentors once per semester during sophomore year and three times per semester during their junior and senior years. This strategy will complement the peer mentoring scholars will receive during their first two years and the faculty mentorships provided during all four years, creating a formal support network as they transition to STEM careers or graduate programs. To ensure professional mentors deliver mentoring best practices, the PI and Career Advisor will lead mentor training for professional mentors, which will include a review of Avila's Mentoring Handbook and the goals of professional mentorship. The PI and Career Advisor will oversee professional mentorships and provide mentors with ongoing support to ensure all professional mentorships are implemented with fidelity.

Early-Alert Retention Support: Early-alert systems designed to identify students at risk of dropping out are an effective tool for increasing persistence and graduation rates (Donnelly, 2010; Schwartz, 2010). The Quality Initiative will establish a university-wide early-alert system as part of its efforts to improve data analytics (described below). The early-alert system will notify the Dean of Students and Learning Services staff when a student demonstrates signs of attrition. In order to enhance this structure for S-STEM scholars, the Dean of Students will serve on the Leadership Team and generate monthly progress reports for each S-STEM scholar. The Dean of Students will review these reports during monthly Leadership Team meetings and convene with each student's faculty mentor to review the report and discuss best strategies to address identified needs.

Supplemental Instruction (SI): The ACES Program will provide targeted support in rigorous 100- and 200-level math and science courses by enhancing available science and math tutoring with an SI program for science and math courses in which students historically have struggled. SI sessions will serve as recitations led by upper-division science and math majors who have excelled in their majors and demonstrated strong leadership skills. Avila Learning Services staff and STEM faculty will coordinate sessions. S-STEM scholars will be required to attend SI sessions during their first year, after which sessions will be voluntary except when mandated by course instructors or faculty mentors. Before leading SI, the SI instructor will meet with course instructors to review materials and, when feasible, attend the class. Research studies have found a strong correlation between SI that utilizes peer-to-peer learning approaches and increases in academic achievement and retention (Bok, 2006). One California State University study found that students who participated in an SI program were one-third less likely to drop out of a STEM major and also less likely to have to repeat a math or science gateway course (CSUF, 2013).

First Year Seminar (FYS): FYS is a foundational 1-credit course for all incoming students that prompts them to articulate their mission in life by urging them to consider what gives meaning to their academic work and future pursuits. The course integrates summer reading with writing and discussion and provides an introduction to campus resources and support services. The Quality Initiative enhanced FYS by adding activities such as career goal development, résumé writing, and interviewing skills practice. The ACES Program will deliver a FYS specifically for S-STEM scholars

and other STEM students to include strategies that have demonstrated success in increasing student persistence and retention and that address need areas faculty commonly identify among low-income STEM students, such as financial planning and time management (Goodman and Pascarella, 2006). Each S-STEM scholar will also develop individual STEM academic and career goals in FYS, and faculty mentors will work with scholars to track progress in meeting these goals.

Career Development: An Avila Career Advisor from Career and Counseling Services (CCS) will serve on the Leadership Team and lead annual informational sessions on career services for S-STEM scholars. These will include topics such as job searching, résumé writing, interview skills, professional etiquette, and financial planning. These sessions will take place during an S-STEM Seminar workshop. In addition to ensuring S-STEM scholars utilize existing CCS services, the Career Advisor will collaborate with the PI and STEM faculty to monitor the provision of CCS services for S-STEM scholars and identify ways to enhance services for STEM majors.

Data Analytics: As part of the Quality Initiative, Avila has contracted with an operational analytics firm to develop systems to improve data analytics. The S-STEM Program will enhance these efforts by creating a STEM Student Success Dashboard that will enable STEM faculty and administrators to better understand STEM student problems related to low retention and graduation rates, diagnose contributing factors, and formulate data-driven responses. The Dashboard will allow faculty and administrators to monitor and analyze on-track indicators by discipline and student subgroup and better understand which milestones students are failing to reach, which subgroups struggle most to reach each milestone, and why students are not reaching milestones. The Dashboard will segregate students by level of participation (dosage) in services implemented with the S-STEM Program (see Section J). This will serve as an invaluable data resource for the evaluator, researcher, and STEM faculty and administrators and enable the Leadership Team to measure the impact of services and strategies. Data generated will stimulate conversations that lead to data-driven improvements in curriculum, instruction, support services, and institutional policies.

ii. New student support elements: In addition to building on the Quality Initiative, the ACES Program will implement several new curricular and co-curricular enhancements.

S-STEM Cohort: The ACES Program will implement a cohort model to facilitate learning, promote community, and foster an S-STEM identity. Participation in small learning communities has demonstrated success in improving STEM student retention and academic success (Shapiro and Levine, 1999), and research has found that cohort models can better prepare students with the interpersonal skills required in the 21st century workforce (Sapon-Shevin and Chandler-Olcott, 2001). Upon entering the program, scholars will form a cohort of eight students and remain in the cohort throughout the program. The cohort will participate in a Living/Learning Community, take common courses, and participate in a number of cohort activities designed to build the cohort and improve scholar academic success and preparation for STEM careers and graduate programs.

Learning/Living Community: Studies have found that Living/Learning Communities assist postsecondary students with academic and social transitions (Inkelas et al., 2007) and can foster a sense of belonging (Johnson et al., 2007). All S-STEM scholars who reside on campus will be assigned to the S-STEM Scholar Living/Learning residence hall to strengthen interpersonal relationships and create a natural community of learners. S-STEM scholars who commute will have a designated area within this residence, which will serve as their home base while on campus, providing a place for them to study and to connect with other STEM students. Other STEM majors will also reside in this Learning/Living residence to fill suites according to university practices.

S-STEM Orientation: S-STEM scholars will participate in a half-day S-STEM orientation following Avila's full-day first-year student orientation. This event will be led by the PI and faculty in S-STEM

disciplines, provide an overview of the S-STEM program, and include a number of cohort-building activities among S-STEM scholars and STEM faculty.

S-STEM Seminar: The PI and STEM faculty will design and implement S-STEM Seminar, a monthly event that will emphasize collaborative learning, community building, STEM career and graduate program exploration and preparation, and life skills development. S-STEM Seminar is based on studies demonstrating that STEM undergraduate students benefit from exposure to STEM careers and graduate programs throughout all four undergraduate years (Brown et al., 2009). S-STEM Seminar will include i) sessions with STEM faculty, researchers, and STEM industry experts to connect students to STEM professionals and provide opportunities to explore career options; ii) sessions led by Avila alumni who are working in STEM fields or attending STEM graduate programs; iii) sessions to assist scholars with GRE preparation and graduate school applications; and iv) workshops specially designed to address identified S-STEM scholar needs (e.g., financial literacy, time management). While S-STEM Seminar will be available to all STEM majors, S-STEM scholars will be required to attend a minimum of seven of the nine sessions per year.

Common Course Work: In order to build strong S-STEM cohorts and effectively deliver embedded academic support, all S-STEM scholars take at least two courses together as a cohort during their first year in the program: First-Year Seminar (FS 101) and English Composition I (EN 111). Scholars majoring in computer science or software engineering will take the following first- and second-year course sequence as a cohort: Understanding Computers (CS 110), Intro to CS I (CS 120), Intro to CS II (CS 121), Intro to SE Careers (CS 195), and Data Structures (CS 222). S-STEM scholars majoring in biology or BMB will take the following course sequence as a cohort: General Biology I (BI 111), General Biology II (BI 112), General Chemistry I (CH 131), and Intro to Research (BI 392).

Redesigned Courses and Sequence: Research opportunities and exposure to STEM careers early in students' postsecondary experience are contributing factors to motivating STEM students to complete their degrees and preparing them for careers and graduate programs (Hathaway et al., 2002; Kuh, 2005; Taraban, 2008). The Biology Department will redesign the 3-credit Intro to Research (BI 392) course and move the course from senior to sophomore year to provide early engagement in scientific research. All computer science and software engineering majors will take Intro to SE Careers (CS 195) during the second semester of their first year (previously offered to sophomores) to build interest in computer-related careers (proposed BI392 and CS195 course descriptions attached).

Professional Society Membership and Conference Participation: Computer science faculty will enhance Avila's Computer Club by establishing it as an Association of Computing Machinery (ACM) chapter. This ACM chapter will support S-STEM scholars' and all CS/SE students' professional development by hosting on-campus presentations by professionals, coordinating visits to technology companies to tour facilities and meet with STEM professionals, creating technology-related service projects, and planning trips for members to attend conferences such as the annual conference of the Consortium for Computing Sciences in Colleges: Central Plains. The Pi Iota chapter of Tri-Beta, a national honor and professional society for students of the biological sciences, was established at Avila in 1998 to encourage scholarly attainment, cultivate intellectual interest in the life sciences, and promote appreciation of the value of biological study. S-STEM scholars will be encouraged to become members of Tri-Beta, which will provide opportunities to publish undergraduate research in Tri-Beta's *Bios* and opportunities to attend and present at conferences.

E. S-STEM Project Management Plan

i. Management Plan: The Leadership Team will be led by the PI, Dr. Robert Powell (Professor of Biology), and four Co-PIs: Ron McCleary (Assistant Professor of Computer Science), Dr. Katherine Burgess (Assistant Professor of Biology), Dr. Larry Sullivan (Associate Professor and Dean of the

School of Science and Health), and Dr. Dominick Scalise (Assistant Professor of Psychology). **Dr. Powell** will chair Leadership Team meetings and oversee program administration and management, including i) serving as the program's liaison to NSF and completing reporting requirements; ii) serving on the Selection Committee; iii) maintaining S-STEM scholar records; iv) collaborating with Avila's Institutional Information Management to collect and manage data required to conduct evaluation and the research study; v) collaborating with the Avila Business Office to manage the grant budget; vi) coordinating partnerships; vii) ensuring all Leadership Team members fulfill respective roles and responsibilities; and viii) convening with the evaluator to review findings, determine the program's success in meeting objectives, and lead the Leadership Team in making improvement decisions. **Ron McCleary** will i) serve on the Selection Committee; ii) coordinate and oversee faculty mentoring, internships, and supplemental instruction for computer science and software engineering majors; and iii) coordinate S-STEM Seminar and S-STEM Orientation. **Dr. Burgess** will i) serve on the Selection Committee and ii) coordinate and oversee faculty mentoring, undergraduate research, and supplemental instruction for biology and BMB majors. **Dr. Sullivan** will i) serve as the Leadership Team's STEM administrator, ii) provide administrative support, iii) and collaborate with the Provost to develop plans for the institutionalization and sustainability of ACES Program services and structures that evaluation reports and the research study demonstrate to have a positive impact on STEM student recruitment, retention, graduation, and preparation for STEM graduate programs and careers. **Dr. Scalise** will i) conduct a research study to examine the impact of the ACES Program on student outcomes; ii) advise the Leadership Team on study findings; and iii) provide recommendations on adjusting services and strategies to improve STEM student outcomes.

The following faculty will serve as S-STEM scholar faculty mentors: Dr. Powell, Dr. Burgess, Ron McCleary, Dr. Joseph Roberts (Assistant Professor of Chemistry), and Patrick Kopp (Assistant Professor of Computer Science and Chair of the Computer Science Department).

As the ACES Program is a university-wide initiative that will support low-income STEM students and that is expected to yield results that will impact future departmental and institutional strategies, the Leadership Team will include representation from all Avila offices charged with providing student services. **Brandon Johnson**, Vice President for Enrollment Management, will collaborate with the PI and Co-PIs to develop and execute the S-STEM recruitment plan, advise the Leadership Team of Quality Initiative services and evaluation findings, and provide data reporting on recruitment efforts. **Crystal Bruntz**, Director of Financial Aid, will serve on the Selection Committee, determine scholars' level of financial need, assist scholars through the financial aid process, serve as an S-STEM Seminar speaker on student financial aid and financial planning, and oversee administration and distribution of scholarships. **Joe Barnhill**, Director of Learning Services, will assist the PI and Co-PIs in designing and implementing the SI program and coordinate Learning Services academic support for scholars. **Ladonna Jackson**, Career Advisor, will lead mentor trainings and sessions on career services for S-STEM scholars and collaborate with the PI and STEM faculty to monitor the provision of CCS services for scholars and identify ways to enhance services for scholars. **Darby Gough**, Dean of Students, will coordinate and oversee peer mentoring and assist the PI and Co-PIs in monitoring student progress to identify and address need areas. **Jason Baldwin**, Director of Student Life, will coordinate the Living/Learning residence hall. **David Deitch**, Coordinator of Information Management, will provide the PI with institutional, departmental, and student data and assist with data analytics (e.g., maintaining the STEM Student Success Dashboard) to measure the program's impact and make data-driven decisions. **Bailey Carr**, Director of Alumni and Donor Outreach, will recruit professional mentors among Avila alumni working in STEM industry, track STEM students after graduation to determine employment and graduate program enrollment, and report data to the PI. **Dr. Cathryn Pridal**, Provost, will support the PI by overseeing assignment of faculty duties related to the S-STEM program, identify opportunities for STEM faculty

professional development based on PI and Co-PI feedback and evaluation and research study findings, advise the Leadership Team on emerging issues related to STEM student academic success, and serve as the ACES Program's liaison to Avila's executive leadership and Board of Trustees to ensure the institutionalization of effective S-STEM strategies, services, and structures.

ii. Recruitment, student selection, and replacement of students who lose S-STEM eligibility: Avila will execute a comprehensive S-STEM recruitment plan that will produce a large enough pool of S-STEM applicants to select two cohorts of eight scholars. Avila has a history of success recruiting minority students. As detailed in Section B, 40% of Avila students are minorities, making it one of the most diverse universities in the Midwest. S-STEM recruitment will employ strategies that Avila has found to increase minority student enrollment, such as conducting presentations that emphasize available financial and academic support and providing opportunities for STEM faculty to interact personally with potential applicants from regional high schools.

1) Print marketing and digital marketing: The PI and faculty from S-STEM disciplines will collaborate with the Office of Undergraduate Admission (OUA) to develop S-STEM program print and digital marketing materials. Print materials will include postcards, pamphlets, and posters to be distributed during targeted mailing campaigns and S-STEM recruitment events described below. As part of digital marketing, Avila will develop and maintain an S-STEM webpage, which will be linked to the School of Science and Health website. The S-STEM webpage will include video vignettes such as STEM major and faculty testimonials, descriptions of the S-STEM program and unique opportunities available to S-STEM scholars, and an overview of STEM career opportunities. The S-STEM PI and OUA staff will develop a video specifically for use during the targeted high school recruitment and special events described below. All digital marketing materials will conclude with the contact information of the PI and/or OUA staff and encourage viewers to contact these individuals to learn more about the program. The S-STEM webpage will include a downloadable S-STEM application and inform viewers of upcoming special events.

2) Targeted high school recruitment: Avila has strong relationships with regional high schools, and OUA recruitment counselors conduct extensive targeted recruitment annually at more than 300 regional high schools. Many of these schools have Title I designation (i.e., more than 40% of students are low income) and serve high percentages of minority students eligible for S-STEM scholarships. Avila's VP for Enrollment Management will serve on the Leadership Team and lead S-STEM recruitment efforts in collaboration with the PI and faculty from S-STEM disciplines. At the start of the grant period, the VP of Enrollment Management will regularly convene with the PI and Co-PIs to gain an understanding of the S-STEM program and serve as the OUA's S-STEM recruitment specialist. During high school recruitment events, recruitment counselors will integrate S-STEM program information, showing S-STEM videos, conducting S-STEM Q&A sessions, and distributing S-STEM pamphlets. OUA recruitment counselors will create a roster of high school students in attendance who are interested in receiving more information about the S-STEM program. This roster will include prospective applicants' contact information for follow-up by STEM faculty and future communications that invite students to the S-STEM special events described below.

3) Targeted regional recruitment: Avila will expand purchases of lists of college-bound students through a number of sources (e.g., College & University Student Recruitment Services, College Bound Selection Service, SAT/PSAT, and ACT/PLAN). The OUA will create a roster of Midwest high school students who meet the minimum entrance exam thresholds for S-STEM scholarship eligibility and express interest in pursuing STEM degrees and will conduct a targeted mailing campaign that markets the S-STEM program to these prospective S-STEM scholars.

4) Special events: The PI, STEM faculty, and OUA recruitment counselors will set up S-STEM booths at on-campus STEM-related events, such as the annual Science Bowl, which is a science and

math competition that brings together more than 200 academically talented students from local high schools, and Women in Science, an annual science competition cofounded in 1990 by Avila University and the Association of Women in Science to encourage the participation of women in STEM. In addition to these on-campus events, the S-STEM Leadership Team will hold an annual S-STEM Program Open House, which will include a presentation introducing the S-STEM program, a tour of Avila STEM facilities, and a luncheon with Leadership Team members and STEM faculty. Lastly, OUA S-STEM recruitment counselors will set up S-STEM booths at regional events, such as college and career fairs and events hosted by KC STEM Alliance and STEM industry partners.

The student selection process is described in Section F. If an S-STEM scholar loses scholarship eligibility, the PI will notify the Leadership Team and STEM faculty, who will then recommend high-performing students with financial need enrolled in S-STEM disciplines. Upon receiving recommendations, the PI will contact each student and encourage him or her to apply. Eligible transfer students will also be encouraged to apply. The Selection Committee will review applications and select the applicant who scores highest on the selection criteria (see Table 3).

F. Student Selection Process and Criteria

i S-STEM scholarship selection and retention criteria: Several recruitment strategies will target students from groups traditionally underrepresented in STEM (e.g., events at Title I high schools, recruitment booths at Women in Science events), and the selection criteria below were designed with consideration given to the diverse backgrounds and goals of applicants. As detailed in Table 3, the selection process will be based on academic merit, financial need, potential to excel in the program, and potential to succeed in STEM professions and graduate programs.

Table 3: Student Selection Criteria	
Areas of Consideration	Criteria Measures
Citizenship/Residency Status (Required)	Applicants must be U.S. citizens, nationals, legal permanent residents, or refugee aliens.
Declaration of Major (Required)	Applicants must declare a major in one of the four S-STEM degree programs.
Full-Time Status (Required)	Applicants must be full-time degree-track students.
Financial Need (Required)	Applicants must demonstrate a high level of financial need, as determined by the Director of Financial Aid and defined by the FAFSA.
High School Academic Performance (30%)	Applicants must have a minimum cumulative 3.0 GPA.* Completion of AP STEM courses and participation in extracurricular and co-curricular STEM-related activities will also be considered.
Entrance Examinations (30%)	Applicants must have a minimum cumulative ACT score of 24.*
Letters of Recommendation (10%)	Applicants must submit a letter of recommendation from a high school science or math teacher.
Video Introduction or Essay (15%)	Applicants must submit a short video (or essay) in which they introduce themselves and discuss their personal and career goals and interests.
Interview (15%)	The Selection Committee will interview all final applicants via in-person interviews with applicants who live within 50 miles of Avila and web-based interviews (e.g., Skype) with those who live outside the local area.

* The Selection Committee recognizes that GPA and test scores are not always reflective of students' ability or potential to succeed in higher education and the STEM workforce. Therefore, the Selection Committee will consider candidates who score slightly below these criteria as long as they demonstrate strengths in other areas.

The S-STEM Selection Committee will be composed of Dr. Powell, Ron McCleary, Dr. Sullivan, Dr. Burgess, Dr. Linda Cleveland (Associate Professor of Chemistry), Crystal Bruntz, and Tyler Seabaugh. Table 4 provides the S-STEM scholar selection process timeline.

Timeline	Selection Activity
11/1	S-STEM scholarship application deadline
11/1-11/7	Selection Committee reviews and scores applications individually, using a rubric outlining minimum qualifications and weighted scoring of each application criterion in Table 3
11/8-11/15	Selection Committee meets to discuss the merit of each application and select finalists
11/15-11/30	Selection Committee interviews all finalists and selects successful applicants
12/1	Selection Committee sends scholarship award notification letters to successful applicants
12/15	Selected applicants accept the scholarship*

* If successful applicants do not accept a scholarship, the Selection Committee will send scholarship award notification letters to the highest-scoring remaining candidates until all scholarships are awarded.

The Leadership Team will review each scholar's academic standing at the end of each semester to determine S-STEM scholar eligibility for scholarship retention. Scholars who meet scholarship retention criteria (see Table 5) will receive a renewal scholarship. Scholars who do not meet retention criteria will be placed on probation during the following semester and will lose their S-STEM scholarship if retention criteria are not met during two consecutive semesters. (See Section E.ii for a description of the replacement of students who lose S-STEM scholarships.)

Area of Consideration	Criterion Measure
Academic Performance	S-STEM scholars must maintain cumulative and major GPAs of at least 3.0.
Academic Progress	S-STEM scholars must remain on track to graduate in four years.
Participation	S-STEM scholars must demonstrate continued interest in pursuing STEM careers or graduate programs and be active members of the S-STEM cohort, as determined by participation in S-STEM activities (e.g., attend seven of nine S-STEM Seminars, attend 85% of scheduled mentorship meetings).

ii. Mechanism by which scholarships will be provided: Avila's Director of Financial Aid will serve on the Leadership Team and assist scholars through the financial aid process. After the selection process, the Selection Committee will provide the Director of Financial Aid with a list of scholarship recipients and award amounts, and she will offer scholars a financial aid package that includes all applicable federal, state, and institutional aid and the S-STEM scholarship. S-STEM scholarships will supplement (not supplant) all other financial aid available to S-STEM scholars. The Director of Financial Aid will apply the S-STEM scholarship directly toward each scholar's tuition and fees.

iii. Program evaluation and dissemination: See Section J for a description of program outcomes evaluation and Section K for a description of dissemination of program outcomes.

G. S-STEM Student Support Services and Programs

Section D describes S-STEM scholar curricular and co-curricular support services and programs that will enhance student learning, confidence, academic performance, retention to graduation, and STEM career and graduate program preparation. Section D also describes the required faculty mentorship, student cohort components, industry partnerships, and ways that existing services will be adapted to meet S-STEM program objectives. The S-STEM recruitment plan is described in Section E.ii.

H. Quality Educational Programs

Avila is accredited by the Higher Learning Commission of the North Central Association and offers 60 undergraduate and 5 graduate programs grounded in scholarship with well-defined educational outcomes and a focus on communication, critical and creative thinking, and academic knowledge. Avila employs the educational framework of High-Impact Educational Practices as defined by the AACU and provides all students with First-Year Experience, common intellectual experiences,

learning communities, writing-intensive courses, collaborative projects, undergraduate research, diversity/global learning, service- and community-based learning, internships, and capstone courses. In 2014, Avila was named to the President's Higher Education Community Service Honor Roll for the sixth consecutive year. This designation, administered by the Corporation for National and Community Service and the U.S. Department of Education, is the highest honor a university can receive for its commitment to volunteering, service-learning, and civic engagement.

S-STEM disciplines are taught by highly qualified faculty who hold the highest degrees in their fields and/or have extensive STEM industry experience (see Bio Sketches). Two STEM faculty members are recipients of the Missouri Governor's Award for Excellence in Teaching. As demonstrated in the attached Facilities, Equipment, and Other Resources document, Avila has invested heavily to provide STEM majors with state-of-the-art biology and computer science laboratories, equipment, and software required to conduct undergraduate research and projects, including a \$3 million renovation in 2014 to improve Avila's microbiology, chemistry, and instrument lab and create a new general science lab and student research room.

STEM majors complete a foundational course sequence during their first three semesters, and faculty revise curricula annually based on student evaluations, surveys of other universities, and recommendations from industry and professional societies. As research has demonstrated that STEM majors who complete more STEM courses early in their undergraduate careers are more likely to persist in their majors (Chen, 2013), Avila recently redesigned its biology and CS curricula to engage freshmen in STEM courses. During the 2014–15 academic year, STEM freshmen completed an average of 14 STEM credits. All STEM majors complete research or capstone projects during junior and senior years. Research experiences include drafting a research proposal, conducting original research, writing a thesis, and presenting work to the department and/or at professional conferences. As noted in Section A, Avila faculty have a history of securing NSF REU awards, and Avila biology majors participate in research annually (see student publications in References Cited). Studies have found that undergraduate research increases students' understanding, confidence, and awareness; clarifies STEM interests; and increases students' motivation to pursue a STEM PhD (Russell, 2007). As early opportunities to participate in research help STEM undergraduates see themselves as scientists earlier in their academic careers (Graham, 2013), Avila will redesign S-STEM discipline course sequences to include research during sophomore and junior years (see Section D). As part of the core curriculum in computer science and software engineering, majors also complete a 120–160-hour internship, in which they develop a project plan, weekly status reports, and final written reports.

I. Generation of Knowledge

In addition to evaluator-led assessment, which will determine the program's success in meeting objectives (see Section J), the researcher will conduct a *qualitative investigation of the lived experiences* (Wertz, 2005) of S-STEM scholars to address the following research question: What impact do S-STEM support services have on low-income STEM student retention, persistence to graduation, and career preparation? To date, the bulk of the peer-reviewed literature exploring S-STEM students' reactions has focused only on quantitative data, which the program evaluation will cover. A rigorous qualitative exploration will provide additional data on how the S-STEM support services are experienced in real time and following students' matriculation, using students' own words and taking into consideration the intersection of their cultural identities.

Qualitative investigation will include individual and group interviews that the researcher will analyze for themes related to students' retention, persistence, and career development during each year of their participation (i.e. at the end of each academic year) in addition to six months following graduation or following a student's dropout from the program. The researcher will also conduct interviews with key Leadership Team members and S-STEM faculty mentors at the middle and end

of each academic year to determine their impressions of the strengths and weaknesses of the program. The researcher will utilize qualitative data analysis software and Consensual Qualitative Research methodology (CQR; Hill et al., 1997) given its emphasis on analytic rigor and validity checks in providing a valid content analysis for qualitative data. The researcher will lead a team of psychology graduate students to aid in reaching a consensus interpretation of the data, as indicated by the CQR protocol (Hill et al., 1997). This design will be supplemented with repeated, quantitative measures of the enrolled students' perceived career maturity, career decision making, and career obstacles with matched comparison samples selected from the non-scholar Avila STEM students as an additional indicator of program efficacy (Yelamarthi & Mawasha, 2010). Given the small sample size, these data will be descriptive of low-income STEM students and will help generate hypotheses about the ACES Program's efficacy for potential follow-up analyses by the research team. Research study results are expected to be beneficial to other small liberal arts institutions with small STEM student cohorts and an interest in implementing strategies to improve low-income STEM student first-year retention, persistence to graduation, and career preparation.

J. Assessment and Evaluation

The PI will participate in NSF-led data collection activities and oversee data collection required for program evaluation. Dr. David Wissman, Avila Professor of Sociology, will serve as the ACES Program's external evaluator and conduct formative and summative evaluations. The PI will present and lead discussions on evaluation findings during one Leadership Team meeting per semester, during which the Leadership Team will review all formative assessments detailed below and discuss ways to build on successes and address areas requiring improvement. The evaluator will develop annual reports and a final report, which will evaluate the program's success in meeting objectives, S-STEM scholars' progress, student and faculty satisfaction with program activities, and the program's impact on STEM departments and university. As described in Section K, the PI and STEM faculty will broadly disseminate evaluation report and research study findings in order to advance knowledge of the impact of curricular and co-curricular support on low-income STEM student outcomes.

Objective 1: Enroll 16 academically talented students with financial need in Avila's biology, BMB, computer science, or software engineering program and increase total enrollment in these majors by 20% by the end of the grant period. Formative assessment: i) The number of S-STEM applications received per recruitment activity, as identified on students' S-STEM applications; ii) the number of enrolled scholars per recruitment activity, as identified on S-STEM applications; and iii) results of S-STEM scholar and Leadership Team surveys, which provide qualitative feedback regarding the perceived effectiveness of recruitment strategies. Summative assessment: i) The number of S-STEM scholars enrolled in the ACES Program, as determined by enrollment records, and ii) the overall increase in S-STEM discipline enrollment, as determined by comparison of enrollment records at the end of each year with the baseline established at the beginning of the program.

Objective 2: Enhance student support services for S-STEM scholars and low-income students in S-STEM disciplines to ensure that 93% of scholars are retained from freshman to sophomore year and 81% of S-STEM scholars graduate within four years and to increase the first-year retention rate in S-STEM disciplines to 83% and the 4-year graduation rate in S-STEM disciplines to 58%. Formative: i) Results of faculty mentoring reports, which provide assessment of each S-STEM scholar's progress toward graduating in four years and identify the student support services perceived to be most beneficial to S-STEM scholars, and ii) results of S-STEM scholar and Leadership Team surveys, which provide feedback regarding the perceived quality and effectiveness of each student support service. Summative: i) The number of S-STEM scholars retained in the program each semester, as determined by enrollment records, and ii) the number of S-STEM scholars who obtain a STEM degree within four years of entering the program, as determined by graduation records.

Objective 3: Provide early engagement in research, early exposure to STEM careers, and enhanced career services to improve S-STEM scholar career readiness and ensure 85% of scholars secure STEM employment or enter a STEM graduate program within one year of graduation. Formative: i) Results of S-STEM scholar surveys, in which they report on their perceived level of career and graduate school preparedness as well as the career and graduate school preparation services they found to be most beneficial, and ii) results of Leadership Team surveys, in which members evaluate the quality of S-STEM Seminar and CCS services. Summative: Results of S-STEM scholar surveys administered at 3, 6, and 12 months after graduation, in which S-STEM graduates report on employment and graduate school status.

Objective 4: Increase Avila's capacity to collect and analyze student data in order to effectively diagnose STEM student needs and assess the impact of supportive curricular and co-curricular activities on STEM student success. Formative: Results of Leadership Team surveys, in which members provide qualitative feedback on STEM Student Success Dashboard improvements and gaps in facilitative STEM student data collection and analyses. Summative: Results of evaluator review of STEM Student Success Dashboard functionality and Leadership Team use of data.

Objective 5: Develop, formally adopt, and implement a plan to sustain S-STEM activities that evaluation results demonstrate to be effective in low-income STEM student recruitment, retention to graduation, and preparation to enter the STEM workforce or graduate programs. Summative: Evaluator review of Avila's formally adopted plan to institutionalize ACES Program activities.

K. Dissemination

The Leadership Team is committed to documenting evidence of effective practices and disseminating findings to individuals and institutions that share the goal of improving STEM scholarship programs and increasing low-income students' success in STEM degree programs and careers. In addition to sharing findings during monthly Leadership Team meetings, the PI and Co-PIs will lead efforts to widely disseminate findings through the following strategies:

Dissemination to faculty, staff, administrators, students, and community members: The PI and Co-PIs will formally present findings annually at a School of Science and Health meeting, Avila faculty assembly meeting, and Avila Board of Trustees' Learning Environment Committee meeting; publish results in Avila's alumni magazine, *Accent*; and post results on the department websites. S-STEM scholars will present research conducted in the program and discuss the program at Avila Student Scholars Day and research seminars. To reach members of the STEM business community, the Leadership Team will create an annual newsletter and a poster highlighting program activities and key findings, provide these items to the community relations staff of STEM industry partners, and request that information be disseminated through company-wide newsletters and communications.

Dissemination to STEM educators and student aid professionals: Avila faculty have a strong history of disseminating research findings. Avila faculty serve as editorial board members and reviewers for *Bioscene: Journal of Biology Education* and *BIOS*. Avila STEM faculty and students have recently published in the *Journal of Computational Science Education* and presented research at conferences of the Association of Small Computer Users in Education, the Council for Independent Colleges, and the Higher Learning Commission. The PI and Co-PIs will lead Leadership Team efforts to submit articles that discuss key evaluation findings in other peer-reviewed STEM and education journals, such as *The Journal of Higher Education*, the *Journal of College Science Teaching*, the *Journal of Research in Science Teaching*, and *The Journal of Educational Research*. The PI and Co-PIs will also lead efforts to disseminate findings at STEM conferences, such as those of the Association of American Colleges and Universities and conferences specific to each S-STEM discipline.

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