

**State University System
Education and General
2021-2022 Legislative Budget Request
Form I**

University(s):	Florida International University
Request Title:	FIU SMART Pipeline: Strengthening Minority Achievement & Results through Teaching
Date Request Approved by University Board of Trustees:	Expected September 2020
Recurring Funds Requested:	\$3,898,664
Non-Recurring Funds Requested:	\$1,100,000
Total Funds Requested:	\$4,998,664
Please check the request type below:	
Shared Services/System-Wide Request	<input type="checkbox"/>
Unique Request	<input checked="" type="checkbox"/>

- I. Description** – 1. Describe the service or program to be provided and how this issue aligns with the goals and objectives of the strategic priorities and the 2020 University Accountability Plan established by your institution (include whether this is a new or expanded service/program). If expanded, what has been accomplished with the current service/program? 2. Describe any projected impact on academic programs, student enrollments, and student services. University of Distinction proposals should also address the requirements outlined in the separate guidance document.

Program Overview

FIU’s **FIU SMART Pipeline: Strengthening Minority Achievement & Results through Teaching** will transform and reengineer STEM programs and courses to optimize the retention, graduation, marketability, career creation and placement of science, mathematics, engineering, and computer science students—thereby launching a new STEM paradigm. The Initiative will 1) integrate best program-of-study practices and deploy state of the art evidence-based instruction and advanced classroom assessment throughout critical STEM courses for all STEM majors; 2) implement interventions that promote mental health and wellness, especially for first generation and millennial students; 3) further develop the recently established School of Universal Computing, Construction, and Engineering Education (SUCCEED) to propagate best practices, assess and provide critical feedback to stakeholders; and 4) leverage these initiatives to catalyze

external investment and promote national prominence. The overarching goal is to drive greater efficiencies through shared system resources.

The State's economic prosperity is the impetus for this paradigm shift. It drives us to optimize the development, retention and ultimate graduation of future engineers, computer scientists, mathematicians, and scientists, as they will play an essential role in the knowledge economy. STEM professionals, including computer scientists and engineers, are at the cutting edge of next wave technological innovations and imperatives that are changing the economic model of our nation and the world, including the internet of things, blockchains, cyber security, and virtual markets. This proposal integrates FIU's two most impactful student success initiatives: the Graduation Success Initiative (GSI) and the STEM Transformation Institute, and leverages past legislative investments to create a new paradigm for programs of study, classroom instruction, student wellness and ultimately student success. We think about student success, not as we know it today but, as an expanded construct that prepares students for a technologically driven world that continues to evolve at an unprecedented pace. By improving and expanding specific hybrid and online offerings as well as authentic integration of technologies into the classroom. This Initiative will also allow FIU to fully engage all students in a modern, urban university education.

This Initiative leverages prior funding and support for STEM and expands on targets transforming student success and graduation rates through optimizing programs, classrooms, and experiences for STEM students to foster development of 21st century skills necessary in a knowledge-driven economy. Research and assessment of student learning outcomes resulting from the transformations are a core innovation that provides continuous feedback on the initiative, as well as spur expansion across FIU and propagation across Florida's universities and colleges. The Initiative's ultimate goal is to be a sustained producer of a highly skilled and highly adaptable workforce that will serve as a launch pad for innovation and startups as well as attract high-tech companies to South Florida.

The Initiative capitalizes on the opportunities afforded by the breadth of effective evidence-based instructional techniques, wide availability of technological devices that can be utilized for learning, and FIU's established expertise in preparing faculty to implement evidence-based instruction in their classrooms. Effective active learning techniques are well established and understood, yet propagation of these techniques across the STEM courses taken by future engineers is often limited to faculty with expertise in evidence-based instruction. Faculty often teach as they were taught in college, using lectures as the primary method; thus, the barrier to innovative instruction is sufficient, effective professional development. FIU has established interventions with prior funding and has validated this renewed, affirmed approach with an emphasis on Gateway (high enrollment and high dropout) courses for all students.

The Initiative provides critical resources that makes it possible to work across all disciplines to change the landscape and prevent a return to status quo. The focus is on disrupting the current system to establish a change in culture that features evidence-based instruction and data-driven decision making in order to optimize time and financial resources. Thus, parallel elements seek to provide resources to change the physical layout of rooms, develop faculty practices, and establish a team of experts that lead instruction

change and carry out research that enables the data-driven decision making. Changing systems require time for the students, faculty and support structures to adapt to the new paradigm. To date, 70% of faculty teaching the gateway courses (as well as roughly 25% of non-gateway STEM faculty) have been engaged in transforming their courses to active learning modalities. This initiative targets those faculty that have not transformed their practices to date.

The approach has already enabled the launch of pilot projects that garner other external funding and amplifies the initiatives impact (for example the \$1.5M NSF HSI Program to transform calculus instruction, noted below). FIU provides instruction for roughly 1% of the nation's 300,000 calculus 1 students, and 3.8% of the nation's Hispanic students taking Calculus 1). Additionally, it allows us to scale-up successful pilots to positively impact all students by providing faculty professional development and course material creation (such as with the current PreCalculus Pathway instruction initiative, noted below). FIU has the momentum to create, expand and maintain innovative instructional strategies that are impacting student success. State support is key to make these changes permanent and establish a new norm for the system.

Highlights of Current Investments: Active Learning Classrooms

- 18 active learning classrooms renovated to date with support of state funding, ranging from 40 - 270 seats (total 1,485 seats), the 270-seat active learning classroom is likely the largest in the nation.
- Utilization: Fall 2019: 14,022 student enrollments across 257 sections of 166 courses / Spring 2020: 12,921 student enrollments across 269 sections of 156 courses, roughly half of the sections are for STEM courses. Over 200 faculty are utilizing the active rooms each semester.

Learning Assistants impact:

- Mature course transformations that integrate LAs reliably lead to 15-25%, and up to 40% increases in pass rates.
- Learning Assistants are undergraduates who facilitate the learning of their peers in the classroom. The impact is profound, as LAs are near peers that recently succeeded in the classroom and are best able to help their peers while becoming leaders themselves.
- State funding has led to a rapid expansion of the LA Program. In Spring 2020, there were 420 LA assignments in over 60 courses, working with over 70 instructors. LAs impacted roughly 14,000 student enrollments.
- LA Program partnered with CAPS (Counseling and Psychological Services) to develop a Bystander Training to better identify students that may be struggling or in difficult situations and would benefit from campus mental health resources. The Bystander Training has been integrated into the LA Seminar that all new LAs enroll in. Expansion of the program is in development.

Increase in STEM course Passing Rates:

- In the last 6 full academic years, changes in instruction and increases in pass rates has led to an additional 16,000 students passing 21 key Gateway and STEM courses.
- Expanded implementation of a novel, evidence-based General Chemistry curriculum (Chemistry, Life, the Universe and Everything, CLUE) that has led to increased student success (15-20% when compared to traditional instruction) and reduced textbook costs (Free textbook and low cost web-based materials).

- Introductory Physics sections utilizing Modeling Instruction see 40% increases in pass rate when compared to traditional instruction, instructional materials provided free of charge and utilize free online textbooks as reference.
- Calculus: Modeling Practices of Calculus Project (started on FIU funds, secured \$1.5M NSF funding): Finds a 20% average increase in pass rates over several semesters, \$200/course textbook savings, as all course materials are provided at no charge and students may use free online textbooks as reference materials. Department is adopting the curriculum across all sections. At least 4 FCS schools have used / will use the curriculum in Fall 2020
- MAC 1147/ Pre-Calculus Algebra and Trigonometry: The *Precalculus: Pathways to Calculus* research-based problem-solving curriculum. Included restructuring and redesigning post College Algebra sequence from two semesters (one semester of Precalculus Algebra plus one semester Trigonometry) to one semester, reducing course sequence to Calculus by one course. Aggregate pass rates from Fall 18 through Summer 19 were 70%.
- MAC 1105 / College Algebra: Improved web-based modules as well as adaptive, just-in-time pre-requisite assessments to integrate Intermediate Algebra content throughout College Algebra thereby reducing path to graduation for STEM and business majors. Pass rates increased in College Algebra to all-time-high of 73%.

The core classroom design features active, engaged learning where students utilize the practices of scientists and engineers to learn their content. Thus, soft skills essential for careers are developed simultaneously with their content learning. This also optimizes major selection, as learning through the practices of scientists and engineers allows students to evaluate their interest in their selected discipline so they may make informed decisions about careers and have the opportunity to change majors without incurring adding excess credit to their degrees or delaying graduation

Specific objectives include:

- Transform introductory science and mathematics courses and prioritize re-design of the Precalculus through Calculus sequence: Building on the established success of transforming Gateway STEM courses, this objective will improve the instruction of science and mathematics courses taken by all STEM majors. This explicitly targets advancing the current pilot interventions reforming Precalculus and Calculus, scaling effective instruction across the complete Calculus sequence. Calculus has a reputation of serving as barrier for future STEM professionals; however, success in pilot Precalculus and Calculus interventions show sufficient promise that a dedicated effort is included in this initiative. Pilot results include improvement in average pass rates by up to 25% in a randomized, controlled study involving 10 sections. Once established, practices and curricular materials will be shared across the State colleges and universities to foster greater efficiencies through shared system resources.
- Implement interventions that promote mental health, especially for first generation and millennial students: Student mental health is a concern for those transitioning to a university, especially for first generation, urban and millennial STEM students as they need to navigate a complex educational system efficiently, often while working or supporting a family. Our current initiatives (active learning instruction featuring undergraduate Learning Assistants) foster peer learning communities that support positive mental health; however, much more

can be done to improve student acclimatization to the university experience. Thus, this objective will implement interventions that have shown to improve student wellness and timely persistence to degrees. These interventions have been selected to act in concert with the classroom environments promoting mental health, as we know that the stressors on these high-impact educational opportunities and career trajectories plays a critical role in students' ability to complete and succeed. Initial interventions focused on developing contemplative practices in the classroom show positive responses from students. We will investigate which interventions are most effective for our student population, guided by Yeager (2019)'s research on growth mindsets and self-regulation, Walton and Cohen (2007)'s research on belonging and Davidson (2014)'s research on healthy minds. We will prepare faculty, administrators and undergraduate Learning Assistants (LAs) to support mental health and recognize early indicators of concern.

- **Classroom Renovation:** Existing traditional classrooms will be renovated to facilitate active learning using state of the art facilities. FIU is transitioning to active-learning, technology-driven classrooms to promote student engagement of content during class time and dissuading the use of lecture by faculty. New classrooms are now routinely built as active learning classrooms with access prioritized for faculty utilizing active learning and thus incentivizing the best instructional practices. Newly opened active learning classrooms averaged over 80% utilization by active STEM courses, with the remaining 20% of utilization done by other courses. However, requests for the active learning rooms persistently outpace availability and thus the need for additional active learning capacity and have included support for these classroom renovations. We include funding for one-time retrofit of at least 10 of our more outdated traditional classrooms that do not have the design or technological infrastructure that is required by state-of-the-art instructional design. Establish faculty "sand box" for developing instructional practices before deploying across large active learning rooms. Creating a stepwise process allows for faculty to become familiar with the curriculum and implement it with fidelity, before introducing additional variables related to class management in larger settings.
- **Further develop the School of Universal Computing, Construction, and Engineering Education (SUCCEED):** This objective will further develop the first engineering education research school at a majority minority research university, following best practices by national leaders in engineering education (Purdue University, Virginia Tech University, Ohio State University, etc.). Engineering education research is an emergent multidisciplinary field that targets advancing educational practices and research on those practices in order to serve the nation in an economy that persistently relies on engineering, technology and computer science-skilled workforce. Highly-skilled Discipline-based Education Research faculty will provide a continuous improvement cycle on campus as well as spread the knowledge generated throughout the State University System (SUS) and Florida College System (FCS). Further, the faculty in the program will leverage external support from numerous public and private agencies seeking to transform the engineering and computer science educational landscape.
- **Expand CAT and STEM Faculty Fellows program:** This objective will harness the expertise of faculty that have transformed their courses into highly effective

active learning environments and position them as Faculty Fellows to share their expertise with colleagues and accelerate institutional transformation. A pilot program was successfully deployed by the Center for the Advancement of Teaching (CAT) with a small cohort of Faculty Fellows including opportunities for building faculty community and leading faculty professional development initiatives. Faculty communities are known to be an essential tool for fomenting faculty change. This model has the dual objective of developing institutional leaders in innovative instruction while utilizing their expertise to expand the use of active learning practices to new faculty. We will have 10 Faculty Fellows fulfill a one-year term with either CAT or the STEM Transformation Institute. Their roles will include co-leading workshops or book clubs, facilitating faculty learning communities, conducting observations in classrooms to provide feedback to colleagues, and providing recommendations for institutional policies or initiatives. Additionally, Fellows will design a data intensive mini-project to evaluate student success in a particular course or discipline. We will provide course buyouts to allow sufficient time for this role, as well as stipends to compensate their efforts.

To achieve these objectives, specific commitments include:

- Create Education Research team through Discipline-based Education Research (DBER) faculty hires: 10 DBER highly-skilled faculty will be supported through this initiative, providing leadership in implementation and measurement of evidence-based instruction and learning technologies. These faculty will serve as leaders of STEM education research to establish a culture of student learning and progression that will drive the 4-year degree completion agenda, and students' marketability and career creation and placement. They join our current DBER team that consists of top DBER scholars in biology, chemistry, earth science, mathematics, and physics, as well as engineering and computer science education researchers. New hires will target established leaders in their disciplines as well as top junior candidates.
- Operate STEM Faculty Institute: We will operate a Faculty Institute to prepare current and incoming faculty to implement evidence-based instruction in their STEM classrooms. The Institute will operate year-round to provide professional development to faculty prior to and during instruction. The Institute will incorporate analysis of instructional data as well as provide further professional development to extend the course innovation based on evidence. The Institute includes dedicated Online and Hybrid master design programs for faculty. Incoming faculty will be encouraged to arrive in summer to participate, allowing them to be successful from day one. Integrated into the design is establishment of the Center for Advancement of Teaching STEM Faculty Fellows program that will leverage faculty expertise in evidence-based instruction to facilitate faculty adoption of instructional change.
- Provide 300 Learning Assistant Stipends to top FIU students: Undergraduate Learning Assistants (LAs) have been critical catalysts in transformation of STEM courses at FIU, as they facilitate learning with their peers while deepening their own understanding of content and collaboration. LAs improve the success of students in transformed courses, increasing retention and completion. These prestigious scholarships will elevate the LA program, improve success of faculty

course transformations, and expand the LA program beyond the STEM disciplines. LAs also experience improved learning as a result of the experience, thereby serving to improve Florida's workforce. Learning Assistants (LAs) are undergraduates who are hired to facilitate small-group interaction in large-enrollment courses. LAs work ~10 hours per week in various aspects of course transformation. This also supports our students who economically may need to work for supplemental income – they are employed, while on campus and therefore still able to maintain full time enrollment and timely graduation.

- Award 10 DBER Graduate Fellowships: A prestigious graduate student research fellowship program will be created to develop skills as both future university educators and researchers. These Discipline-based Education Graduate Researchers (DBER) will work with the DBER faculty to implement and provide data on student impact and improved faculty instruction. Eligible students will be required to submit National Science Foundation Graduate Research Fellowship applications to support their continued studies.
- Hire 3 Post-doctoral education researchers: The researchers will assess impact of the innovative instructional strategies through student learning outcomes and classroom observations, while extending their training as future university educators and researchers. Their work will be incorporated into the continuous improvement feedback loop. All post-docs will be required to develop at least one external funding proposal.
- Hire 6 Staff for program operations: One LA Program Assistant Director will be hired to manage the LA program and prepare faculty to effectively integrate LAs into their active classrooms, working with faculty and undergraduate LAs. Two Faculty Developers for STEM courses with expertise in education transformation and in the discipline will be hired to prepare faculty to implement Learning Technologies and Evidence-based Instruction in their classroom. The Developers will provide year-round support and feedback. One Database Analyst will be hired to carry out statistical analyses on the project as well as develop data analytics dashboards for STEM stakeholders. The project will be managed by a program manager and an administrative assistant to support the faculty and staff team members as well as LAs and graduate fellows.
- Classroom Renovations: Existing traditional classrooms will be renovated to facilitate active learning in STEM classrooms using state of the art facilities. New classrooms are now routinely built as active learning classrooms with access prioritized for faculty utilizing active learning, thus incentivizing the best instructional practices. The recently opened active learning classroom with 270 seats averaged over 85% by large active STEM courses. This utilization rate is typical of all of our active learning classrooms on campus. However, requests for the active learning rooms persistently outpace availability. Further our hybrid course redesign relies on active learning rooms to be effective, thereby increasing need each year. We include funding for one-time retrofit of ten of our more outdated classrooms that do not have the design and technological infrastructure that is required by state-of-the-art teaching and learning classrooms. These retrofits will include several rooms designed as “sand boxes” for faculty develop and test new innovative instructional practices.

Related Accomplishments

The Initiative builds on the success of multiple projects that have brought significant change to the university and that have become integrated into university practices and culture. FIU's STEM interventions began in physics, expanded into multiple STEM disciplines, and are now being led through the STEM Transformation Institute. Evidence of success in the reformed introductory physics courses includes significantly improved conceptual learning, the first reported increase in student attitudes towards physics, and a sustained 40% increase in the passing rate, when compared to traditional courses, realized by a dozen different faculty teaching the course. This has led to a dramatic increase in the number of physics majors and national recognition for FIU's success.

FIU is focused on raising its 4-year graduation rate and successfully increased this from 28.4% in 2016 to 42.6% in 2019. We build our efforts on the foundational success of our Graduation Success Initiative (GSI) and Gateway Project. FIU's GSI has helped raise the six-year graduation rate for First Time in College students (FTICs) by 16 points in its first four years. During the past three years of LBR funding, we have seen a 10.6 percent improvement in our four-year graduation rate, a 6 percent increase in the second-year retention rate, and a 3.9 percent increase in the issuing of bachelor's degrees without excess hours. Institutional analytics determined that poorly performing gateway courses are a significant barrier in students' path to timely graduation, leading to the Gateway Project.

The first major success in the Gateway Course initiative was the comprehensive transformation of the College Algebra course that included Learning Assistants and innovative technology-based instruction, leading to a sustained 35-40% increase in passing rates for all students. Improvements in the pass rate for the College Algebra course has saved over 3,500 seats between fall 2012 and fall 2018 (compared to fall 2010 baseline). These improvements significantly improve efficiency through direct cost savings to our students as well as reducing excess hours and thus improving timely graduation. In AY 2016 – 2017, the legislative investments for course redesign of Finite Mathematics and Social Choice Math, Gateway course taken by non-STEM majors, resulting in consistency in content and expectations across sections and increases in average pass rates (+12% and +16% respectively). With well over 3,000 students enrolled in these three courses each semester, the impact is significant. Looking across our Gateway courses in mathematics, when compared to 2013-14 passing rates, improvements have resulted in more than 8,000 additional successful course completions.

Funding support of prior smaller-scale initiatives has led to a core of interventions, which has begun to lay the foundational framework for STEM at FIU. At the core of both the STEM and Gateway initiatives are interventions that 1) adapt evidence-based instructional practices to the FIU context; 2) require faculty engaging students in meaningful, active learning in the classroom; 3) are initiated by external grant or foundation funding; and 4) engage undergraduates, faculty, and administration as partners in the transformation.

One powerful and cost-effective approach is the undergraduate Learning Assistant (LA) program, which provides undergraduates with the opportunity to experience the reward of teaching, develop skills to engage in the challenges of effective instruction, and deepen their content knowledge. At the same time, they serve a critical role as dedicated and

skilled facilitators in the classroom, thus easing the transition for both students and faculty to active learning. FIU hosts the nation's largest LA program, with 318 LAs serving in 130 course sections across 14 STEM departments, impacting over 12,000 student enrollments in Spring 2019 (enrollment includes duplicated headcount as students may have LAs in more than one course). Lessons learned in these initiatives are spreading to other courses, where pilot projects have seen an average increase in passing rates of 18% across 7 courses (two of which increased over 25%), which will translate to improved graduation rates in the coming years. Further, enrollment in one transformed course more than quadrupled over the past several years, doubling in annual offering as well as enrollment. On-time graduation rates have also increased 16% in four years.

The Initiative's ultimate goal is to attract high technology companies to Florida, as well as fuel entrepreneurial innovation, thus driving the economic prosperity of the state. This will be achieved both through the reputation earned by our engineering and computer science graduates as well as through the evidence on student learning outcomes accumulated through the initiative.

Further practices, curricula, and evidence generated by this initiative will be shared with all SUS and FCS institutions, allowing them to adopt and adapt practices for their use, fostering greater efficiencies through shared system resources. This provides the opportunity to position Florida as the first State in the nation to implement evidence-based instruction and learning technologies throughout the engineering and computer science programs.

Alignment with SUS Strategic Priorities / 2020 FIU University Accountability Plan

The Initiative is very well aligned with the goals of the SUS 2025 System Strategic Plan (including *Improve the quality and relevance of the System's institutions* and *Increase Degree Productivity and Program Efficiency*) as well as the SUS Strategic Priorities in Teaching & Learning; Scholarship, Research & Innovation; and Community & Business Engagement. First, it will increase the number of degrees awarded at FIU, especially in the STEM fields, as well as the quality of those degrees by transforming instructional practices. Second, it will increase research commercialization activities through providing a workforce well-prepared for driving a knowledge economy and triggering start-up companies. Further, the program and classroom transformation and education research outcomes have the potential to lead to commercialization. Third, it directly increases the community and business workforce, as our graduates will be well prepared to be fully employed in their disciplines upon graduation or to seek further educational opportunities.

The initiative immediately addresses the SUS Strategic Priorities, including:

- ***Strategic Priorities for a Knowledge Economy: GOAL: Increase the Number of Degrees Awarded in STEM/Health and Other Programs of Strategic Emphasis*** *Increase student access and success in degree programs in the STEM/Health fields and other Programs of Strategic Emphasis that respond to existing, evolving, and emerging critical needs and opportunities.* This directly addresses improving both the quantity and quality of not only Engineering and Computer Science degrees but all other STEM degrees as improvements to

- foundation courses, such as the calculus sequence, that will benefit all STEM majors.
- **Strategic Priorities for a Knowledge Economy GOAL: Increase Research Commercialization Activities:** *Increase the number of patents, licenses and start-up companies created as a result of university research.* The initiative develops students' inquiry, collaboration and out-of-the-box thinking skills, thus providing them the opportunity to make authentic and significant contributions to the knowledge economy. Furthermore, improvements throughout the engineering and computer science programs will serve to produce more innovative and fully-developed senior research projects increasing the likelihood of successful patents, licenses, and start-ups.
 - **Strategic Priorities for a Knowledge Economy: GOAL: Increase Community and Business Workforce** *Increase the percentage of graduates who continue their education or are employed full-time.* The project optimizes the preparation of Engineering and Computer Science STEM majors, so they may either continue their education or rapidly enter the workforce.

The initiative immediately addresses FIU's 2020 Accountability Plan goals and objectives, including:

- **Mission:** Provides *high-quality teaching and state-of-the-art-research* for our students and diverse population of South Florida.
- **Goal:** Aligned to becoming top 50 public university: *FIU will continue to advance the institution's mission to be a top 50 public university by placing laser-like focus on aligning FIU's entire academic culture, resource investments, institutional priorities, and global perspective to achieve unprecedented excellence in higher education.*
- **Strategy:** Bringing the best educational and research practices is essential in FIU's as a *major contributor to our local economy and graduates the future leaders and innovators in those fields.*
- **Strategy:** Developing new paradigms of evidence-based instruction now are essential for the future, as *the demand for jobs is nearly insatiable. The Florida Chamber Foundation Florida 2030 Project estimates that 1.7 million more jobs will be needed in the state within 11 years. In part the project calls for a renewed focus on talent supply and education to help the state prepare for this growth.*
- **Key Initiatives & Investments 1) Amplify Learner Success & Institutional Affinity:** Directly impacts FIU's commitment to *student success is intricately tied to a greater sense of institutional affinity, individual grit, a well-nurtured sense of belonging, and optimism towards the future.* Thus, this initiative drives FIU's *first key initiative is therefore designed to deliberately support learners at every phase of their academic journey. FIU is well positioned to shift the higher education paradigm to meet the needs of the rapidly changing world of work by building upon our unique strengths and opportunities. To this end, we will continue to create and implement high-tech and high-touch innovative solutions that accelerate our students' academic and career success. Our focus is to foster 21st century, employment-ready, proud FIU graduates, who are technologically, creatively, and culturally agile. At the same time, we are committed to creating an*

environment that stimulates lifelong learning and builds synergistic networks, which dynamically and organically connect our students, teachers, researchers, alumni, community partners, and entrepreneurs.

- Key Initiatives & Investments 2) **Accelerate Preeminence & Research and Innovation Impact Preeminent Programs**; The STEM Transformation Institute, leading the initiative, is one of six Preeminent Programs. This initiative directly impacts FIU's *second key initiative is designed to advance our current academic standing by leveraging FIU preeminent and emerging preeminent programs that focus on generating new knowledge and innovative solutions for the betterment of our environment, health, and society. This will drive our visibility to solidify FIU as a leading urban public research university. To achieve this, we will strive to attract and retain the most productive faculty, while cultivating leaders and nurturing all students, postdocs, researchers, and staff to excel. During the next three years, we will focus on optimizing interdisciplinary collaboration through our Preeminent and Emerging Preeminent programs to seek large center research grants, and grants that focus on technological innovation, as well as on graduate student training... Our aim is for FIU to be the **catalyst** to foster social innovation and entrepreneurship from conceptualization to commercialization.*
- Key Initiatives & Investments 3) **Assure Responsible Stewardship**: Aligns with optimizing resource management: *consistently practice sound financial management while aligning resources with academic priorities that sustain knowledge production, optimize learning, discovery and creativity, and promote a positive working environment.*
- Top Three Performance-based Funding Metric Impacts through this Initiative:
 - (4) FTIC Four-Year Graduation Rate
 - (5) Academic Progress Rate
 - (6) Percentage of Bachelor's Degrees Awarded within Programs of Strategic Emphasis
- Top Three Preeminent Research University Funding Metric Impacts through this Initiative:
 - (3) Freshman Retention Rate
 - (4) Four-year Graduation Rate
 - (6) Science & Engineering Research Expenditures

Impact on Academic Programs, Student Enrollments, Student Services

Every STEM student at FIU will benefit from the implementation through new and improved first-year STEM programming, implementation of evidenced-based practices in STEM coursework, and mental health interventions. The culture of teaching and learning in Engineering and Computer Science and all STEM departments will likewise be transformed, toward evidence-based and data-informed improvement. These transformations will reduce individual course failure rates by at least 30% within two years of implementation, leading towards an overall goal of an additional 15% increase in graduation rates. This goal is aligned with the standard of excellence as established by the

SUS Performance Funding Metrics. As was the case in physics, we anticipate increases in the number of Engineering and Computer Science majors.

II. Return on Investment - *Describe the outcome(s) anticipated, dashboard indicator(s) to be improved, or return on investment. Be specific. For example, if this issue focuses on improving retention rates, indicate the current retention rate and the expected increase in the retention rate. Similarly, if the issue focuses on expanding access to academic programs or student services, indicate the current and expected outcomes. University of Distinction proposals should also address the requirements outlined in the separate guidance document.*

The Initiative leverages existing commitments to education transformation and a national climate devoted to classroom education reform. It will increase research capacity and funding opportunities that will lead to increased grant funding, improved student performance, and national recognition. Further, it will stimulate adoption of similar instructional innovation at universities and colleges across the state. The initiative explicitly targets: revitalizing the first-year engineering and computer science programs, preparing faculty to implement innovative instruction in the STEM classrooms, gathering and analyzing classroom data, and disseminating the classroom transformation model for the state. These actions will lead to improved student learning and success in STEM courses that will lead to improved retention, graduation rates, and employment.

The intensive Faculty Institute will provide professional development to least twenty additional faculty annually in integrating evidence-based instruction, cutting edge assessment, and learning technologies in their classrooms, as well as develop instructional leadership in at least 10 Faculty Fellows. This will directly impact approximately 12,000 student enrollments annually, and they will continue to impact similar student enrollments in later years. All STEM students will enroll in at least one of the newly renovated courses within one year of the initiative's launch.

Student mental health/wellness interventions will be expanded in the first semester after initiative launch and impact at least half of the entering STEM students and measures on the impact will be determined over the next two semesters. Within three years, all entering STEM students will have the opportunity to benefit from the interventions.

The model for faculty professional development will be established through research on faculty practices and student impact. It is anticipated that this will lead to the DBER faculty producing at least 80 scholarly products (publications and presentations) annually in the first three years, growing to at least 120 within five years. We also expect all new DBER faculty to attract external funding to the institution within 18 months of hire. All of our recent DBER faculty hires attracted external funding within six months to one year of arrival; almost all have already been awarded more than one grant. These include Dr. Monique Ross' awards of \$1.2M, Dr. Alexandra Strong's awards of \$1M, Dr. Trina Fletcher's awards of \$614K and Dr. Bruk Berhane's awards of \$565K.

The initiative will also drive improved student learning and success in the courses, leading to improved retention and graduation rates. Student learning outcomes are a key

driver to sustained transformative instruction (as well as a critical feedback loop element) and will be reported through the scholarly products. Based on prior FIU initiatives and national trends in active learning, we expect a 30 - 40% decrease in failure rates in large enrollment introductory courses within four semesters of implementing evidence-based instruction. For the courses with failure rates of 20 - 40%, this translates to an 8 -16% decrease in failure rate. We expect this to increase an additional 10% within three years and be sustained for at least a decade. We base this on prior work at FIU and active learning literature. At FIU, College Algebra passing rates increased by 25% after evidence-based instruction was introduced across all sections in Fall 2012, then rising to the current 40% increase in average pass rate (compared to the fall 2010 baseline). We have also seen a 70% decrease in failure rates in our studio-based introductory physics courses, compared to lecture courses. A 2014 Proceedings of the National Academies of Science publication found an average 35.5% decrease in reported failure rates when comparing active learning in all STEM disciplines to lecture courses (www.pnas.org/cgi/doi/10.1073/pnas.1319030111).

We will transform the education experience for FIU’s 12,000 science, mathematics, engineering and computer science majors, over 80% of which are from traditionally underrepresented minority groups and 25% of which are first generation students.

Ultimately, this initiative drives economic development by substantially improving learning and skill development for our students, as well as enhancing efficiency in degree attainment. Our graduates will be well prepared to tackle existing, evolving, and emerging critical needs and opportunities in the global society and technology driven marketplace. They will be the innovators, entrepreneurs, and start-up leaders of the future. Their reputation for solving global challenges will attract the top technology companies to South Florida. Thus, FIU will be *the* reliable catalyst for South Florida’s highly skilled and diverse engineering and computer science workforce.

III. Facilities *(If this issue requires an expansion or construction of a facility, please complete the following table.):*

	Facility Project Title	Fiscal Year	Amount Requested	Priority Number
1.	Active Learning Room Renovations	2021/22	\$900,000	
2.	Faculty “Sand Box” Classroom	2021/22	\$200,000	

2020-2021 Legislative Budget Request
Education and General
Position and Fiscal Summary
Operating Budget Form II
(to be completed for each issue)

University: Florida International University
Issue Title: FIU SMART Pipeline:
Strengthening Minority
Achievement & Results
through Teaching

	<u>RECURRING</u>	<u>NON- RECURRING</u>	<u>TOTAL</u>
<u>Positions</u>			
Faculty	10.00	0.00	10.00
Other (A&P/USPS)	9.00	0.00	9.00
	-----	-----	-----
Total	19.00	0.00	19.00
	=====	=====	=====
<u>Salary Rate (for all positions noted above)</u>			
Faculty	\$1,225,641	\$0	\$1,225,641
Other (A&P/USPS)	\$552,500	\$0	\$552,500
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Total	\$1,778,141	\$0	\$1,778,141
	=====	=====	=====
Salaries and Benefits	\$2,378,641	\$0	\$2,378,641
Other Personal Services	\$1,345,223	\$0	\$1,345,223
Expenses	\$175,000	\$0	\$175,000
Operating Capital Outlay	\$0	\$1,100,000	\$1,100,000
Electronic Data Processing	\$0	\$0	\$0
Special Category (Specific)	\$0	\$0	\$0
	\$0	\$0	\$0
	\$0	\$0	\$0
	\$0	\$0	\$0
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Total All Categories	\$3,898,864	\$1,100,000	\$4,998,864
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