State University System
Education and General
2020-2021 Legislative Budget Request
Form I

University(s):	**Florida International University**
Issue Title:	**Targeted STEM Initiatives**
Date Issue Approved by University Board of Trustees:	**September 5, 2019**
Recurring Funds Requested:	**$3,898,664**
Non-Recurring Funds Requested:	**$1,100,000**
Total Funds Requested:	**$4,998,664**
Please check the issue type below:	
Shared Services/System-Wide Issue for Fiscal Year 2020-2021	☐
Unique Issue for Fiscal Year 2020-2021	☒

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 2019 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.*

Program Overview

FIU's **Targeted STEM Initiatives** will transform and reengineer STEM programs and courses to optimize the retention, graduation, marketability, and 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 critical 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 strategic priority. 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. The Initiative 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 courses for all students. The Initiative provides the resources, professional development, and assessment necessary for transforming the science, mathematics, engineering and computer science educational paradigm, thereby providing our students with the best instructional practices available in the nation. This round of funding will enable FIU to scale the interventions from prior pilots and targeted designs.

Specific objectives include:

- Transform introductory science and mathematics courses and target 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'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 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 classroom averaged over 80% utilization by active STEM courses. However requests for the active learning rooms persistently outpace availability and thus we include support for classroom renovations. We include funding for one-time retrofit of at least 10 of our more outdated 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 step-wise 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 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 the 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 now clearly focused on raising the 4-year graduation rate. 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 two 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 evidenced 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 / 2019 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 2019 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 deliberatively 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) Six-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.*

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.

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	2020/21	$900,000	
2.	Faculty "Sand Box" Classroom	2020/21	$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 Unviersity**
Issue Title: **Targeted STEM Initiatives**

	RECURRING	NON-RECURRING	TOTAL
Positions			
Faculty	10.00	0.00	10.00
Other (A&P/USPS)	9.00	0.00	9.00
Total	19.00	0.00	19.00
Salary Rate (for all positions noted above)			
Faculty	$1,225,641	$0	$1,225,641
Other (A&P/USPS)	$552,500	$0	$552,500
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
Total All Categories	$3,898,864	$1,100,000	$4,998,864

State University System
Education and General
2020-2021 Legislative Budget Request
Form I

University(s):	**Florida International University**
Issue Title:	**Base Funding**
Date Issue Approved by University Board of Trustees:	**April 19, 2019**
Recurring Funds Requested:	**$17,000,000**
Non-Recurring Funds Requested:	
Total Funds Requested:	**$17,000,000**
Please check the issue type below:	
Shared Services/System-Wide Issue for Fiscal Year 2020-2021	☐
Unique Issue for Fiscal Year 2020-2021	☒

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 2019 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.*

Florida International University seeks $17M in base funding to continue its upward trajectory focused on student success and research excellence.

This request of $17M, integrated with the $15M provided by the Legislature during the 2019 session will complement and advance the goals of Florida International University's *2025 Next Horizon Strategic Plan*.

The Strategic Plan's vision is for FIU to achieve exceptional student-centered learning and upward economic mobility, produce meaningful research and creative activities, and lead transformative innovations locally and globally, resulting in recognition as a **Top-50 public university.** The Strategic Plan's Framework has three pillars: 1) Amplify Learner Success & Institutional Affinity, 2) Accelerate Preeminence & Research and Innovation Impact, and 3) Assure Responsible Stewardship.

The *2025 Next Horizon Strategic Plan* builds on achievements reached during FIU's BeyondPossible 2020 Strategic Plan. These major achievements include:

- Entering U.S. News and World Report ranking of top 100 public universities.
- Achieving Carnegie Research I designation.
- Ranking #15 in patent production among public universities, #28 among all U.S. universities and #33 globally.
- Increasing the 4-Year graduation rate by 57% (from 24.8% in 2010-14 cohorts to 38.9% in 2014-18 cohorts).
- Increasing the Academic Progress rate by 14.4% (from 76.9% in 2013-14 to 88% in 2017-18.
- Increasing doctoral degree production by 57% from 2013-14 to 2017-18 (from 257 to 404); and an expected growth of 68% by the end of 2018-19 (432 doctoral degrees awarded).
- Increasing Science & Engineering research expenditures by 83% (from $107M to $196M).
- Increasing Science & Engineering non-Medical research expenditures by 51% (from $101M to $153M).

Base Funding Detailed Breakdown:

Amplify Learner Success & Institutional Affinity

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. This strategic priority area is designed to 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 geography and diverse demography. With this LBR's funding, 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, whose mindsets are technologically, creatively, and culturally agile. At the same time, we are committed to creating an environment that stimulates and facilitates lifelong learning including the certification of critical competencies such as analytic, interpersonal, global, and professional skills as well as technological and data literacies. We will build synergistic networks, which dynamically and organically connect our students, teachers, researchers, alumni, community partners, and entrepreneurs to expand our knowledge economy. Throughout, we will focus on student success and wellbeing.

High Touch Student Support ($257,314)
A "success coaching" model that is intrusive in the first six months of a student's college experience has proven to be effective, especially for students with a level of "risk" for attrition or lack of engagement. The check points with the students will be scheduled early and often in the student's career and the conversation would include some of the items the student declared in the entry survey used by the University. This request builds on the initial funding we have received and will build on our successful model of centralized College Life Coaching through funding of:

- Peer Success Mentors
- Success/College Life Coaches
- Training of Student Mentors

Faculty Recruitment/Teaching ($2,432,282)
We will accelerate the recruitment of new faculty, with the recruitment of focusing on curricular areas with highest demand. These new faculty members will focus on offering undergraduate level courses in various modalities to meet student demand and supply additional class sections required to ensure timely degree completion. This increase in faculty focusing on teaching will support increases in course offerings during the Summer Term, making FIU a "Year-Round University." The recruitment will have a mix of Junior and Senior Faculty, appropriate to the discipline and learning.

Industry Competency Recognition ($93,807)
An important component of FIU's 2025 Next Horizon Strategic Plan is learner success through alignment with industry workforce needs. This funding will support software developers to provide support in the four core areas of industry competency:

- Identification and badging "essential" skills
- Identification and badging industry-recognized credentials throughout degree programs
- Alignment of essential skills to University Core Curriculum
- Development and/or alignment of continuing education for workforce development

Learning Assistants ($397,477)
The use of Learning Assistants (LA) has been a key factor in FIU's improved graduation and retention rates. FIU's STEM Transformation Institute has been a national leader in developing and testing the effectiveness of LA-

supported undergraduate education. LA-supported classrooms produce greater student learning outcomes and higher graduation and retention rates. This funding will continue the expansion of Learning/Writing Assistants by providing stipends.

Mental Health and Wellbeing ($649,949)
To achieve the highest levels of learner success, we are focusing on "High Touch Student Support." This approach largely focuses on academic success through the use of Learning Assistants (LAs), retention scholarships, plus the addition of faculty to focus on curricular needs. Student success also depends on student wellbeing. This request focuses on developing preventive educational programs and training of staff and faculty on prevention, early detection, supports and resources and referrals. The addition of Case Managers and Mental Health Therapists will provide necessary support for these programs.

Predictive Data Analytics for Student Success ($243,422)
A successful "High Touch Student Support" requires concurrent data analytics to inform a more intrusive student support model. This funding will provide a robust in-time system for analyzing student engagement and attendance. Such a system will allow faculty, mentors, advisors, and counselors to quickly intervene to address student success challenges.

Recruitment Scholarships and Retention/Completion Grants ($1,500,000)
This funding will expand the merit scholarship budget towards the goal of improving the incoming student profile, as well as retaining and accelerating the graduation rates of FIU students. These funds also support students who face unexpected emergencies and financial circumstances that impact their ability to remain enrolled.

Year-Round University/Student Admissions Pathways ($2,299,507)
An important component of the 2025 Next Horizon Strategic Plan is achieving Top 50 Public University rankings, with dramatic improvement in 4-year graduation rates. To achieve this goal, the university must increase the courses offered throughout the year, inclusive of Summer Term, in effect becoming a "Year-Round University." This funding will aid in increasing summer teaching and the availability of course offerings year-round and within terms.

Continued success in student metrics requires better coordination of student recruitment and admissions pathways. Of particular importance is successful alignment of student goals with continuous admissions and year-round academic and career-focused pathways. This funding will support staffing for improved student recruitment and admissions.

Accelerate Preeminence & Research and Innovation Impact

This strategic priority is designed to advance our current academic standing by leveraging FIU's preeminent and emerging preeminent programs that collaborate across disciplines to generate 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 best, most productive faculty, while cultivating leaders and nurturing all students, postdocs, researchers, and staff to excel.

FIU will expand its knowledge ecosystem marked by research innovation unfettered by discipline or geography to craft grand solutions to the complexities of modern society. We will continue to leverage our success as a global academic leader to drive knowledge production that informs public and academic conversations on societal and cultural issues. We will support our faculty, allowing them to achieve national recognition for their excellence in teaching, research, scholarship, and creative activities. Finally, FIU will be the catalyst to foster social innovation and entrepreneurship from conceptualization to commercialization.

Amplify Culture of Innovation & Entrepreneurship ($1,694,906)
As a Research I university, FIU strives to make a positive impact through new knowledge and cutting-edge research that leads to solutions to societal challenges. One important aspect of that impact is our capacity to move research results from the laboratory or clinic into new or improved products and services in the marketplace. Our success in translating research results into new inventions has placed FIU at the forefront of patent production. This is an important role for a university in today's knowledge-driven economy.

Moreover, decision-making is an essential skill demanded of every leader and policy maker in any organization or industry. Good decision-making, however, is what differentiates the legacies of these leaders and the success of their organizations. In today's technology-enable, fast-paced environment, leaders are under tremendous pressure to make good decisions faster. The result is that decisions are often made, and programs initiated without a comprehensive and

informed analysis from cross-disciplinary stakeholders. In other words, decisions are made, and precious financial resources are invested on the basis of perspectives and/or unverified assumptions.

To address this critical need, the FIU decision-making laboratory, will provide a platform for informed decision making by combining technology and analytical tools that will allow policy makers, decision makers, and business leaders the ability to test solutions and alternatives in a laboratory setting prior to expensive implementation. The design of the decision-making laboratory enables diverse teams of stakeholders to gather into one room to address complex challenges. What differentiates this gathering from traditional "committee" meetings is the underlying technology embedded within the decision-making laboratory that would provide the stakeholders with tools such as **data visualization**, **predictive modeling and simulation**, and **expert analysis**.

The requested funds will accelerate commercialization and entrepreneurships by providing infrastructure support for commercialization of patents and collaboration with industry. In addition, these funds will accelerate the following initiatives:

- Work with industry, government officials and university experts to develop Disaster Planning and Response Project to help build the resilience of our community when disaster strikes.
- Student workshops and training on data visualization, predictive modeling and analysis within the Decision Lab.
- Establish an entrepreneurial network utilizing the decision-making laboratory to incubate and launch new companies and create jobs.
- Host intensive, immersive 2-3-day hackathons around key challenges such as infrastructure, city planning or student success utilizing the decision-making laboratory.
- Develop workshops and informational sessions for FIU faculty to understand and utilize the Decision Lab to successful attract more research grant funding from traditional federal sources or unique industry sources.
- Launch industry targeted events to facilitate partnerships and projects around the decision-making laboratory.

Doctoral Student Support ($638,379)

FIU's doctoral degree production has increased by 68% since 2013-14, with increases in research doctorates of 38%. In the implementation of our new Strategic Plan we will dedicate some of the financial support of doctoral students to FIU's Preeminent and Emerging Preeminent programs. This will support the

continued success of these programs by being able to recruit the best and brightest doctoral student candidates. Since the Preeminent programs are ones that receive the most external research grants and drive FIU's innovation, this investment will in turn increase external funding for doctoral students and amplify FIU's innovation impact.

Faculty Recruitment/Research ($4,663,548)
Faculty are the main driver of research growth at a University. To maintain Carnegie R1 Highest Research designation and continue to progress and achieve the 2025 Strategic Plan goals, FIU must dedicate resources to recruiting incremental faculty that focuses on research and innovation. The addition of faculty will have an impact beyond research, as they also contribute to student success metrics.

Research Administration Support, Infrastructure & Grant Writing ($1,095,941)
FIU's progress to Carnegie I Research classification, and SUS Emerging Preeminence has produced significant increases in total research expenditures, external grant proposals, and external grant awards. These funds will provide additional Office of Research and Economic Development staff to assist Principal Investigators with grant needs from pre-award to post-award and will allow researchers to dedicate more time to their research instead of working on administrative tasks. Importantly, the funds will provide technical grant writing support to the Preeminent programs with the focus on competing for large multidisciplinary grant so agencies such as the NIH. Further, to support new faculty hires, space must be renovated to account for additional labs and ongoing research needs.

Undergraduate Research Expansion ($134,010)
Undergraduate research experiences have been shown to improve student success and retention. Research experiences outside of the classroom impact the nature of a student's peer group; the quality and quantity of student interaction with faculty outside the classroom; the integration of a student's academic and social lives. Moreover, research experiences that make coursework more relevant leads to the development of skills and knowledge that can be transferred to the classroom setting. These funds will increase undergraduate research peer mentors and provide for support of collaboration between undergraduate students and faculty in the laboratories, with a focus in creating a bridge from undergraduate to graduate education for undergraduate students interested in pursuing graduate education.

Assure Responsible Stewardship

Both of the initiatives below consist of short-term expenditures that will lead to significant future savings and increased space utilization for faculty and students which together with this initial investment will be reinvested in student success and faculty initiatives consistent with the strategic plan.

Agile Workforce ($275,000)
FIU has an opportunity to create an agile workforce that will foster engagement, productivity, creativity and innovation. This initiative is targeted at improving space utilization by having by having back-office non-student or faculty-facing operational staff work remotely on flexible schedules.

With mobility and remote working being a way of life today, organizations are opting for smaller desk numbers and employing unassigned and social spaces to accommodate mobile and remote workers when they are present. As stated by Global Workplace Analytics, a globally recognized authority on creating agile workplace strategies, "Organizations that continue to use 19th Century workplace designs and 20th Century workplace practices to do 21st Century work will not survive."

By definition, an agile workforce is the ability to have multiple work models that allows the organization to fluctuate between them to best serve the needs of the business. The traditional team that is on site, the teleworker working from home, temporary/seasonal employees and contractors are all examples of the type of teams that support the agile workforce model.

Startup costs include training for managers on how to manage remote workers and manage by performance, the cost of analysis of jobs that would lend themselves to telecommuting, needed hardware for home office setups, home monitors, and additional technical support.

Shared Services Assessment & Implementation ($624,460)
Seeking greater operational efficiency and effectiveness, innovative leaders continue to push their campuses and their own offices to implement shared services to achieve both quality and financial improvements. Research reveals that shared services extend to nearly every aspect of higher education operations, from printing services to donor prospect research.

The five most common functions for shared services are finance, information technology, human resources, procurement, and payroll. Most of these

functions are largely considered "back office," in that they rarely interact with students or external constituents.

By realizing savings or generating revenue through shared services models, FIU may redirect resources and reinvest savings in mission-critical initiatives and activities tied to university goals impacting metrics specific to student success and research excellence. These can also result in space management efficiencies and optimized space utilization complementing the agile workforce initiative.

Costs of implementation include purchasing new technology, assessing current staffing levels and structures, and hiring some new staff in key functional areas during transition to shared services.

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.*

The return on investment will be measured by the increase in student success and research outcomes projected below. When achieved, accomplishing these goals will also support our increased recognition and reputational gains in national and international rankings. FIU's 2025 stretch goal is to be ranked in the Top 50 Public Universities by U.S. News and World Report.

FIU will also contribute to the SUS goal of Florida continuing to lead in higher education across the nation. Competition for economic drivers such as corporations, business infrastructure and R&D is estimated to only increase across the states, and we believe FIU's relative contributions to these SUS goals will help to retain existing and drive new business and industry to Florida.

The LBR request focuses on Learner Success and Acceleration of Preeminence and Research Innovation Impact. These are pillars of FIU's 2025 Next Horizon Strategic Plan; thus, the Return on Investment (ROI) will be in these two areas.

Specifically, we expect:

- The FTIC 4-Year Graduation Rate to improve by 54% (from 38.9% in 2018 to 60% in 2025.
- The FTIC 6-Year Graduation Rate to improve by 23% (from 57% in 2018 to 70% in 2025).

- The FTIC 2-Year Retention Rate to improve by 2.3% (from 88% in 2018 to 90% in 2025).
- Average cost to student/net tuition to decrease by 25% (from $11,930 in 2018 to $9,000 in 2025).
- Total doctoral degrees to increase by 49% (from 404 in 2018 to 600 in 2025).
- Total research PhD degrees to increase by 58% (from 200 in 2018 to 315 in 2025).
- Total Research Expenditures to increase by 53% (from $196M in 2018 to $300M in 2025).
- Science & Engineering Research Expenditures to increase by 52% (from $166M in 2018 to $252M in 2025).
- Non-Medical Science & Engineering Research Expenditures to increase by 53% (from $153M in 2018 to $234M in 2025).
- Industry-related research and design to increase by 115% (from $9.3M to $20M).
- Patent license options executed per year to increase by six-fold (from 4 in 2018 to 30 in 2025).

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.	N/A	N/A	N/A	N/A

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: **Base Funding**

	RECURRING	NON-RECURRING	TOTAL
Positions			
Faculty	42.50	0.00	42.50
Other (A&P/USPS)	41.67	0.00	41.67
Total	84.17	0.00	84.17
Salary Rate (for all positions noted above)			
Faculty	$5,295,000	$0	$5,295,000
Other (A&P/USPS)	$2,513,148	$0	$2,513,148
Total	$7,808,148	$0	$7,808,148
Salaries and Benefits	$10,463,699	$0	$10,463,699
Other Personal Services	$2,476,155	$0	$2,476,155
Expenses	$4,060,146	$0	$4,060,146
Operating Capital Outlay	$0	$0	$0
Electronic Data Processing	$0	$0	$0
Special Category (Specific)	$0	$0	$0
	$0	$0	$0
	$0	$0	$0
	$0	$0	$0
Total All Categories	$17,000,000	$0	$17,000,000