PROGRAM MODIFICATION PROPOSAL FORM

Name of Institution: Medical University of South Carolina

Briefly state the nature of the proposed modification (e.g., adding a new concentration, extending the program to a new site, curriculum change, etc.): Add a track to the Master of Science of Dentistry degree, track in Digital Dentistry

Current Name of Program (include degree designation and all concentrations, options, and tracks): MSD (with tracks in Orthodontics, Periodontics, Endodontics, and Pediatrics)

Proposed Name of Program (include degree designation and all concentrations, options, and tracks): Add track in Digital Dentistry

Program Designation:

- ☐ Associate's Degree
- ☒ Master's Degree
- ☐ Bachelor's Degree: 4 Year
- ☐ Specialist
- ☐ Bachelor's Degree: 5 Year
- ☐ Doctoral Degree: Research/Scholarship (e.g., Ph.D. and DMA)
- ☐ Doctoral Degree: Professional Practice (e.g., Ed.D., D.N.P., J.D., Pharm.D., and M.D.)

Does the program currently qualify for supplemental Palmetto Fellows and LIFE Scholarship awards?

- ☐ Yes
- ☒ No

If No, should the program be considered for supplemental Palmetto Fellows and LIFE Scholarship awards?

- ☐ Yes
- ☒ No

Proposed Date of Implementation: June 2019

CIP Code: 51.0502

Current delivery site(s) and modes: MUSC, on campus (traditional)

Proposed delivery site(s) and modes: MUSC, on campus (traditional)

Program Contact Information (name, title, telephone number, and email address):

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Institutional Approvals and Dates of Approval:

College of Dental Medicine MSD Curriculum Committee: 5/18/2018
MUSC College of Dental Medicine Dean: 12/05/18
Education Advisory Committee: By poll, 1/2/19
Provost's Council : 1/14/19
MUSC Board of Trustees: 2/8/19

Background Information

Provide a detailed description of the proposed modification, including target audience, centrality to institutional mission, and relation to strategic plan.

The Master of Science in Dentistry is a post-graduate degree program in which all students must be licensed dentists and admitted to a post-graduate residency training program at MUSC. The students complete the MSD (in one of the approved tracks) while they complete the residency, ultimately earning a master's degree as well as the ability to take the Board exam for their dental specialty.

This program modification requests the addition of a fifth track, Digital Dentistry. **Digital Dentistry is the practice of dentistry employing available and emerging technologies to better diagnose and treat dental patients with greater precision, faster production, and lower costs**. This track is unique from the other tracks in that students will not be concurrently completing a post-graduate residency program. Rather, they are licensed dentists (either from US or abroad) or students who have graduated from an accredited dental school who are seeking post graduate training in principles of digital dentistry and how to contribute to the body of knowledge in this area (through instruction in research methodology and teaching).

Technology involved in digital dentistry includes sophisticated 3D imaging and planning software for surgical and restorative planning and implementation. Additionally, digital dentistry deploys the latest Computer Aided Design and Computer Aided Manufacturing pathways for both additive and subtractive manufacturing processes. 3D printing technology such as stereolithography and selective laser melting is combined with subtractive manufacturing processes such as 5 axis milling. The use of these innovative technologies results in higher value dental care (better outcomes at lower cost) than has been available in the past and training the next generation of dental practitioners in these innovations aligns with MUSC's mission as an academic health science center committed to innovations in health care.

Assessment of Need

Provide an assessment of the need for the program modification for the institution, the state, the region, and beyond, if applicable.

There are about 2,200 licensed dentists (including 1,500 general dentists) practicing in South Carolina (Source: South Carolina Office for Healthcare Workforce, February 2018). About 16% of dentists nationwide have adopted elements of digital dentistry in their practice and the rate is increasing. The growth in adoption is due in part to the fact that digital dentistry **can help improve both affordability of care and access to care**. The anticipated lower cost and increase in affordability of care will help economically disadvantage populations by bringing low cost state of the art treatment to rural areas. This Program will focus on digitally fabricated in house prosthetics such as 3D printed dentures. The clinicans graduating from this program will learn how to fabricate prosthetics inoffice using 3D printing technology. This eliminates the cost and time of sending things to far away laboratories. Furthermore many economically disadvantaged folks can not afford to take extra time of work for multiple dental appointments. The ability to 3D print and mill crowns and other restorations in house eliminates the need for multiple appointments and decreases the time spent away from work.

Digital dentistry allows the general dentist to provide care or products that formerly needed specialized services or laboratories. For example, the dentist can make final restorations more affordable using 3D printing and milling,

therefore avoiding laboratory bills and subsequent transfer of those costs to the patient. Many digitally-fabricated prosthetics such as crowns and inlays can be fabricated in a single visit, thus reducing costs and travel burden to patients. Moreover, the general dentist can perform more complicated procedures such as 3D guided implant placement and digital dentures (which expands treatment options to residents in areas that do not have dental specialists).

One bottleneck to greater utilization of these technologies and the benefits they afford is that the equipment is very complicated to master, and dentists need specific training. There are few training programs in the country, and none in the state. The proposed track in Digital Dentistry will provide graduates the skills they need to incorporate the latest techniques and technologies in their practices and communities.

Transfer and Articulation
Identify any special articulation agreements for the modified proposed program. Provide the articulation agreement or Memorandum of Agreement/Understanding.

N/A

Description of the Program

Projected Enrollment						
Year	Summer Headcount		Fall Headcount		Spring Headcount	
	New	Total	New	Total	New	Total
2019	2	2	0	2	0	0
2020	2	4	0	4	0	4
2021	2	4	0	4	0	4
2022	2	4	0	4	0	4

Explain how the enrollment projections were calculated.

Two students will be accepted to the program each year in the summer (so the table above assumes new students began in Summer 2019—hence, zero new students in the Fall of 2019, and 2 new students each summer; for purposes of projections, the Summer column in each row is presumed to be the Summer of the next calendar year. The program length is 2 years (six semesters), approximately 36 credit hours (including 17.5 credit hours of coursework specific to the digital dentistry track).

Curriculum

Attach a curriculum sheet identifying the courses required for the program.

Curriculum Changes

Courses Eliminated from Program	Courses Added to Program	Core Courses Modified
		Students will take digital dentistry courses in addition to the core curriculum courses for the MSD

		(GDENT prefix). Digital Dentistry courses (all will have GDIGT prefix) are described below. This is a non-thesis masters degree.

Curriculum

Curriculum by Year					
Course Name	**Credit Hours**	**Course Name**	**Credit Hours**	**Course Name**	**Credit Hours**
Year 1					
Summer 1		**Fall 1**		**Spring 1**	
Research Methods and Biostatistics GDENT xxx	1.5	Teaching Methods GDENT 801	1.5	Research GDENT 899	1
Digital Basics xxx	2.5	Fixed Prosthodontics* GDIGT xxx Prerequisite FXPRO-806	2.5	Fixed Prosthodontics * GDIGT xxx Prerequisite FXPRO-807	2.5
Patient simulations * GDIGT xxx	2	Oral Biology and Pharmacology GDENT xxx	1	Neuroscience and Behavioral Modification GDENT xxx	1
Digital Dental Materials * GDIGT xxx	2	Anatomy and Developmental Biology GDENT xxx	1	Oral Pathology, Physiology, Immunology, and Wound Healing GDENT xxx	2
Smile Design GDIGT* xxx	1	Structured Literature review	1	Ethics, Professionalism, and Practice Management GDENT xxx	1
Structured Literature review GDIGT* xxx	1	3D Printing in Dentistry * GDIGT xxx	1	Research Application GDIGT* xxx	1
				Structured Literature review	1
Total Semester Hours	**10**	**Total Semester Hours**	**8**	**Total Semester Hours**	**9.5**
Year 2					

Summer 2		Fall 2		Spring 2	
Esthetic dentistry * GDIGT xxx	1	Research GDENT 899	1	Research GDENT 899	1
Research Aplication GDIGT* xxx	1	Research Application GDIGT* xxx	1	Research Application GDIGT* xxx	1
Fundamentals of Implant Surgery and Grafting GDIGT xxx	1.5	Community Outreach* GDIGTxxx	1	Community Outreach* GDIGT xxx	1
Implant Prosthodontics* GDIGTxxx Prerequisite PROS-821	1.5				
Advanced Digital Mentorship* GDIGTxxx	2	Advanced Digital Mentorship* GDIGTxxx	2	Advanced Digital Mentorship* GDIGTxxx	2
Structured Literature review	1				
Total Semester Hours	**8**	**Total Semester Hours**	**6**	**Total Semester Hours**	**6**

*** indicates classes specifically added for the Digital Dentistry Program**

Course Descriptions for New Courses

New Courses

List and provide course descriptions for new courses.

Digital Basics, 2.5 cr Concepts of comprehensive patient care with an emphasis on treatment planning, modern restorative concepts, digital dentistry will be reviewed.

Patient Simulations, 2 cr. Intense laboratory simulations will occur with patient simulations and Objective Structured Clinical Examinations. Examinations will have an emphasis on partial and complete coverage CAD/CAM restorations and tooth preparation efficiency and quality.

Digital Dental Materials, 2 cr. This course will review the material properties and directions of use for the most common dental materials utilized with digital workflows. This included Zirconia, lithium disilicate, leucite and nano-ceramic materials along with 3D printed polymer resins and nanocomposites.

Smile Design, 1 cr. Students will learn the concepts of digital smile design to include both 3D and 3D smile design on various different software systems.

Literature review, 1 cr. Students will review and discuss current research and innovations in digital dentistry.

3D Printing in Dentistry, 1 cr. Students will learn the fundamentals of various types of 3D printing to include the most popular technologies used in dental applications. Stereolitography (SLA), digital light projection (DLP) and filaments deposition modeling (FDM) will be the main focus.

Fixed Prosthodontics II, 2.5 cr. Students will serve as a supplemental instructor in this course working side by side with undergraduate dental students. FXPRO-806 reviews the fundamentals of occlusion. Here virtual dynamic articulation will be reviewed along with mastery of various tooth preparations.

Fixed Prosthodontics III, 2.5 cr. Students will serve as a supplemental instructor in this course working side by side with undergraduate dental students. FXPRO-807 reviews the fundamentals of adhesive ceramic tooth preperatoins.

Esthetic dentistry, 1 cr Students will learn how to treat complex esthetic cases and how to plan for veneers and crowns in the anterior dentition.

Fundamentals of Implant Surgery and Grafting, 1.5 cr. 3D printed digital surgical guide fabrication and implant placement principles will be reviewed in this course to prepare the student for clinical placement of implants.

Advanced Digital Mentorship, 2 cr. Students will work closely with faculty on digital laboratory prosthetics, CBCT implant planning and 3D printing and 3D face scanning concepts. Students will experience Virtual Reality surgical planning. Students will learn concepts of Zirconia milling, sintering and characterization. Students will also mentor other undergraduate students in the implant and CAD/CAM clinics and assist with digital prosthetic fabrication.

Community Outreach, 1 cr. Students will learn community-based health care best practices and apply knowledge in a community health center (ECCO Clinic)

Similar Programs in South Carolina offered by Public and Independent Institutions

Identify the similar programs offered and describe the similarities and differences for each program.

Program Name and Designation	Total Credit Hours	Institution	Similarities	Differences
None				

Faculty

State whether new faculty, staff or administrative personnel are needed to implement the program modification; if so, discuss the plan and timeline for hiring the personnel. Provide a brief explanation of any personnel reassignment as a result of the proposed program modification.

MUSC can provide the expertise needed for this concentration using our existing talent.

The Director of Digital Dentistry track will be assumed by an existing faculty member at 1 FTE or two existing faculty members at ½ FTE (each) as co-directors.

Administrative support for the addition of this track will be assumed by the administrative assistants in the Department of Oral Rehabilitation.

Resources

Identify new library, instructional equipment and facilities needed to support the modified program.

Library Resources: No new library sources needed. The resources currently available in MUSC's library are extensive and will support the new track, and includes subscriptions to 13 of the top 15 journals that publish research on Digital Dentistry, and the electronic core textbook Clinical Application of Digital Dentistry.

Equipment: No new equipment needed. All the digital dentistry equipment needed to train the students is available in the James B. Edwards College of Dental Medicine, including

- CEREC Omnicam with MCXL mills
- Sirona MCX5 puckmMill
- Planmeca Emerald with Planmill 40S
- Planmeca Promax CBCT with Proface and 4D jaw motion tracking
- 3Shape Trios with Design Studio
- Planmeca 3D surgical guide module
- Formlabs 3D printer
- VOCO Solflex 3D printer
- Exocad
- 3D ortho Studio
- Simplant implant planning software

Facilities: No new facilities needed. All learning, laboratory, and patient treatment space is available within the James B. Edwards College of Dental Medicine.

Impact on Existing Programs
Will the proposed program impact existing degree programs or services at the institution (e.g., course offerings or enrollment)? If yes, explain

☐ Yes

☒ No

Financial Support

Estimated Sources of Financing for the New Costs						
Category	**1st**	**2nd**	**3rd**	**4th**	**5th**	**Total**
Tuition Funding	$9,200	$18,400	$18,400	$18,400	$18,400	$82,800
Program-Specific Fees	$99,000	$198,000	$198,000	$198,000	$198,000	$891,100
Special State Appropriation						
Reallocation of Existing Funds						
Federal, Grant, or Other Funding [Clinical Revenue]	$204,369	$408,736	$408,736	$408,736	$408,736	$1,839,313
Total	$312,569	$625,136	$625,136	$ $625,136	$625,136	$2,813,113
Estimated New Costs by Year						
Category	**1st**	**2nd**	**3rd**	**4th**	**5th**	**Total**
Program Administration and Faculty and Staff Salaries	$232,363	$397,848	$397,848	$397,848	$397,848	$1,823,755
Facilities, Equipment, Supplies, and Materials	$10,497	$20,994	$20,994	$20,994	$20,994	$94,473
Library Resources						
Other (specify)	$69,709	$206,294	$206,294	$206,294	$206,294	$894,885
Total	$312,569	$625,136	$625,136	$625,136	$625,136	$2,813,113
Net Total (i.e., Sources of Financing Minus Estimated New Costs)	0	0	0	0	0	0

This is designed to be a revenue-neutral program which will help offset expenses for the clinic to practice digital dentistry

Budget Justification

Provide a brief explanation for all new costs and sources of financing identified in the Financial Support table.

- Salaries are listed for existing faculty (so these are shifted from the general budget to the track budget)
- Supply costs include costs for supplies needed to operate the digital dentistry technologies (e.g. 3D printing)
- Other costs include the A&S costs required from the college based on student headcount that support centralized university services, such as student support services.

Evaluation and Assessment

The SLO's below are specific to the Digital Dentistry Track; students will also fulfill SLOs for the MSD. This is a non-thesis masters degree program (though the production of a scholarly work is expected, as it is for all MSD graduates).

Program Objectives	Student Learning Outcomes Aligned to Program Objectives	Methods of Assessment
Proficiency in using technologies of Digital Dentistry	Mastery of digital impressions with multiple systems	Evaluation of students' output by course instructor against a standard
	Mastery of restoration design on multiple systems	Evaluation of students' output by course instructor against a standard
	Mastery of digital removable partial denture design and complete denture design	Evaluation of students' output by course instructor against a standard
	Mastery of 3 Shape laboratory software for smile design and larger prosthetic cases	Evaluation of students' output by course instructor against a standard
	Mastery of 3D printing	Evaluation of students' output by course instructor against a standard
Using Digital Dentistry to provide optimal care	Incorporating CBCT planning of implants as standard of care	Evaluation of students' output by course instructor against a standard
	Merging of intraoral scans with CBCT data for 3D printed surgical guides as standard of care	Evaluation of students' output by course instructor against a standard
	Virtual reality surgical planning	Evaluation of students' output by course instructor against a standard
Implement Digital Dentistry in a community clinic	Practice digital dentistry in a community health clinic	Evaluation of students' output by course instructor against a standard

Will any the proposed modification impact the way the program is evaluated and assessed? If yes, explain.

☐ Yes

☒ No

Will the proposed modification affect or result in program-specific accreditation? If yes, explain; and, if the modification will result in the program seeking program-specific accreditation, provide the institution's plans to seek accreditation, including the expected timeline.

☐ Yes

☒ No

Will the proposed modification affect or lead to licensure or certification? If yes, identify the licensure or certification.

☐ Yes

☒ No

Explain how the program will prepare students for this licensure or certification. This program does not lead to licensure.

If the program is an Educator Preparation Program, does the proposed certification area require national recognition from a Specialized Professional Association (SPA)? If yes, describe the institution's plans to seek national recognition, including the expected timeline.

☐ Yes

☒ No