

PROGRAM MODIFICATION PROPOSAL

Proposing Institution

Clemson University

Title of program modification

Add a new concentration

BA Science Teaching: Physics

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James F. Barker, FAIA
President

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Classification

Program Title: **BA, Science Teaching: Physics**

Academic unit involved: **Secondary Education**

Designation, type, and level of degree: **BA, Science Teaching: Physics (4-year)**

Proposed date of implementation: **Fall 2012 or as soon as approved**

CIP code from the current USDOE's Classification of Instructional Programs: **131316**

Identification of program as New or Modification: **Program Modification; to add a new concentration to the BA in Science Teaching**

Site: **Clemson University campus**

Program qualifies for supplemental Palmetto Fellows Scholarship or LIFE Scholarship awards: **Yes x No**

Delivery mode (see definitions later on in this section): **Traditional**

Justification

A statement of the purpose:

This program modification seeks to attract physics majors into teaching via a dual major option (BA in Physics and BA in Science Education: Physics).

Need for the program in the state:

There has been a critical shortage of physics teachers throughout the nation and statewide for many years. Further, very few programs are producing more than 1-2 physics educators each year. Our current BS in science teaching [teaching area: physical sciences] currently has a few students enrolled, but our intention is to add the proposed BA in science teaching [teaching area: physics] so that students will be able to double major in science teaching and physics. It is hoped that this option will create more students who are interested in pursuing teaching. This expectation is based on our current success with double majors that have been added in 1) math and secondary education and 2) biological sciences and science teaching.

Specific justification comes from the following state information: science teacher shortages have continued to be a critical need list by the State Board of Education. This is determined based on data from CERRA (Center for Educator Recruitment, Retention, and Advancement) that tracks teacher shortages in SC and reports the data to the SDE.

A discussion of the centrality of the program to the mission of the institution as that mission is currently defined by the Commission.

This proposed program modification aligns with Clemson University's long-term focus on Engineering and Science. More recently, STEM education has become a central focus of the Provost and President. Specifically, the University seeks to align initiatives in STEM fields in a more collaborative sense. The proposed program modification unites the content area (Physics) with the School of Education to allow students to achieve a dual major in Physics and Secondary Education: Physics in four years. This increases their future career options as well as increasing numbers in science education.

A discussion of the relationship of the proposed program to other related programs within the institution, including, if possible, description of strengths and weaknesses of the related programs as documented by evaluative reports of institutional and/or Commission consultants.

This program is being added because it will align with the newly adopted dual major in Biological Sciences and Secondary Science: Biological Sciences. We desire to reproduce the existing success with the Biological Sciences department by now adding Physics. Currently, we have a BS in Secondary Science: Physical Sciences, but this does not allow individuals who desire to become experts in Physics to pursue an education degree as well.

A description of similarities or differences between the proposed program and those with like objectives offered at other institutions including discussion of like programs within the state, and especially for graduate programs, the region and the nation. The discussion should include reference to programs offered by independent institutions headquartered in South Carolina, the Academic Common Market, and web-based institutions.

Currently, the following institutions have approved Physics Education programs: (Public Universities) Citadel, Clemson University, College of Charleston, USC-Aiken, USC-Columbia, USC-Upstate and (Private Universities) Converse College, Erskine College, Furman University, Newberry College, and Wofford College. Of the approved programs, none showed any graduates in physics education in 2007-08 according to CHE. The proposed program modification seeks to add a new option for students in an effort to recruit more students. Of the aforementioned programs, none have identified an explicit path for achieving a double major within four years. This proposed program would achieve that.

Enrollment

The admissions criteria will follow the current criteria for all secondary science education majors. Specifically, these students will have met the requirements currently in place for physics majors. In addition, they will have been admitted into the professional program and will have passed all sections of PPST (Praxis I) and a GPA of 2.5 or above.

Projected Enrollment: this dual major option seeks to provide additional options for students that are currently in physics or desire to switch from other majors such as engineering into physics and education. The number of credit hours shown on the table is recorded as zero because we are not seeking to increase the current hours that students take. Rather, we seek to provide additional avenues of study in an attempt to fill high needs careers such as physics teaching. Since it is rare for students to begin by majoring in science education, we expect that most of students will come from students that are currently enrolled at Clemson University.

PROJECTED TOTAL ENROLLMENT						
YEAR	FALL		SPRING		SUMMER	
	Headcount	Credit Hours	Headcount	Credit Hours	Headcount	Credit Hours
2012-13	4	60	4	60		
2013-14	8	120	8	120		
2014-15	12	180	12	180		
2015-16	16	240	16	240		
2016-17	16	240	16	240		

The table below only looks at estimated new enrollment of students. This table is a sub-set of the above table and reflects the previous comments that the majority of students for this program will likely be physics majors or switching into physics or education after being at Clemson University for a semester or two. Credit hours are listed as zero because this proposal is submitted as budget neutral. This is not an attempt to grow the size of Clemson University. Instead, it is meant to better serve the population who are currently here while addressing a critical state need.

ESTIMATED NEW ENROLLMENT						
YEAR	FALL		SPRING		SUMMER	
	Headcount	Credit Hours	Headcount	Credit Hours	Headcount	Credit Hours
2012-13	1	15	1	15		
2013-14	2	30	2	30		
2014-15	3	45	3	45		
2015-16	4	60	4	60		
2016-17	4	60	4	60		

Curriculum

The proposed plan of study meets or exceeds the NCATE SPA requirements for physics education in terms of content and pedagogy. The assessments of student learning will align with the current NCATE SPA plan that is currently in place for science education: biological sciences and science education: physical sciences. All eight assessments that are being used for the NSTA SPA will be aligned to specifically address the needs of those who intent to teach physics in secondary settings. The proposed curriculum plan is detailed below (note that no new courses will be necessary):

**CLEMSON UNIVERSITY
SCIENCE TEACHING—PHYSICS
BACHELOR OF ARTS**

PROPOSED CURRICULUM PLAN 2011-12

FRESHMAN YEAR			
Fall Semester		Spring Semester	
CH 101 General Chemistry	4	CH 102 General Chemistry	4
MTHSC 106 Calculus of One Variable I	4	Arts and Humanities	
ASTR 105 Physics of the universe	3	(Non-Lit.) Requirement ²	3
ENGL 103 Accelerated Composition	3	MTHSC 108 Calculus of One Variable II	4
Foreign Language ¹	3	PHYS 122 Physics with Calculus I	3
Total Semester Hrs.	17	PHYS 124 Physics with Calculus II Lab	1
		Foreign Language ¹	<u>3</u>
		Total Semester Hrs	18
SOPHOMORE YEAR			
Fall Semester		Spring Semester	
MTHSC 206 Calculus of Several Variables	4	MTHSC 208 Ord. Diff Eq	4
PHYS 221 with Calculus II	3	PHYS 222 Physics with Calculus III	3
PHYS 223 with Calculus II Lab.	1	PHYS 224 Physics Lab III	1
ED 105 Orientation to Education	2	ED F 301 Principles of American Education	3
HIST 122 or 124 ³	3	BIOL 111/(104/106)	
BIOL 110/ (103/105)		Principles of Biology II	<u>5/4</u>
Principles of Biology I	<u>5/4</u>	Total Semester Hrs.	15/16
Total Semester Hrs.	17/18		
JUNIOR YEAR			
Fall Semester		Spring Semester	
EDSEC 327 Practicum in Secondary Science	3	ED F 302 Educational Psychology	3
CH 331 Physical Chemistry	3	ED F 335 Adolescent Growth & Development	3
MTHSC 434 or PHYS 311	3	PHYS 441 Electromagnetics I	3
PHYS 321 Mechanics I	3	Oral Communication Requirement ⁴	3
PHYS 325 Modern Lab	3	BIOSC 482 Lab Tech. for Teaching Sci.	<u>3</u>
ED F 315 Tech Skills for Learning	<u>1</u>	Total Semester Hrs.	15
Total Semester Hrs.	16		
SENIOR YEAR			
Fall Semester		Spring Semester	
EDSEC 427 Teaching Secondary Science ⁵	3	EDSP 370 Introduction to Special Education	3
READ 498 Secondary Content Area Reading ⁵	3	EDSEC 447 Teaching Intern. in Sec. Sci. ⁸	9
GEOG 103 ⁶	3	EDSEC 457 Sec. Science Capstone Sem. ⁸	<u>3</u>
Arts and Humanities requirement ⁷	3	Total Semester Hrs.	15
PHYS 455 Quantum Mechanics I	<u>3</u>		
Total Semester Hrs.	15	TOTAL HOURS—128-130	

¹ Two Semesters (through 202) in any modern foreign language or American Sign Language are required.

² See General Education Requirements.

³ Any course(s) that satisfy BOTH a Social Science and an STS General Education Requirement also accepted.

⁴ See General Education Requirements.

⁵ To be taken the semester prior to EDSEC 447 and 457; EDSEC 427 and READ 498 must be taken concurrently

⁶ Any course(s) that satisfy BOTH a Social Science and a Cross-Cultural Awareness General Education Requirement also accepted.

⁷ See General Education Requirements.

⁸ EDSEC 447 and EDSEC 457 must be taken concurrently and are offered only during spring.

Faculty:

Since this is a program modification, we will list the key faculty that have been involved in developing the program instead of every faculty member that teaches in education and physics.

List Staff by Rank	Highest Degree Earned	Field of Study	Teaching in Field (yes/no)
Dr. Jeff C. Marshall (Assistant Prof.)	Ph.D.	Chemistry and Physics Education	Yes
Dr. Michelle Cook (Assistant Prof.)	Ph.D.	Science Education	Yes
Dr. Jeremy King (Full Professor)	Ph.D.	Physics	No

No new faculty members are needed. Dr. Cook and Dr. Marshall are able to handle an increase in the number of science education majors and were hired to help grow the number of students prepared for STEM programs to help address the state and national need for teachers in science.

No additional staff is required for this program.

Physical Plant:

No additional requirements will be needed in the foreseeable future from the physical plant to address the needs proposed in this program.

Equipment:

No additional equipment will be necessary that would not already be sought for normal instructional practice.

Library Resources:

No additional resources are necessary from the library to achieve the proposed program modification.

Accreditation, Approval, Licensure, or Certification

The program as required by state law will be accredited through NCATE. We will seek the same approval as we do for our existing science education initial certification programs. Specifically, we will meet all the requirements outlined by the NSTA SPA. This approval will be achieved on the same time schedule as the existing NCATE programs at Clemson University. Further, any graduates understand that they will have to meet the requirements of the state that they seek to attain certification from. For South Carolina, this includes but is not limited to passing the Praxis II in their field of study.

For the NSTA SPA we will collect data from students that demonstrate that they meet target performance on eight different assessments. The specific assessments are briefly described below:

List of Assessments

Assessment 1—Praxis scores (PPST if taken and both Praxis II scores)

Assessment 2—GPA in content courses (2.5 minimum) and content alignment matrix

Assessment 3—Pedagogy—Unit Plan from science methods course (EDSEC 427)

Assessment 4—Pedagogy—Student teaching evaluations (ADEPT, midterm, final, and CF evaluations). This includes specific evaluations of inquiry instruction and safety issues that are pertinent to science teaching (EDSEC 457)

Assessment 5—Student learning—analysis project on the effects of student learning (EDSEC 457)

Assessment 6—Pedagogy—Safety issues in science. Online reading and quiz on legal and safety issues (BIOSC 482)

Assessment 7—Content—Assessment of research project (BIOSC 482)

Assessment 8—Content—Contextual learning. Collection of various assignments that demonstrate understanding of Nature of Science, Inquiry, and Issues in Science (EDSEC 327)

Articulation

It is expected that the majority of students who will enter the proposed program will do so during the freshman and sophomore year.

Estimated Costs

Assumptions for Table G:

- Although no new faculty members are needed, approximately 3 faculty (2 science educators and the equivalent of 1 FTE physics person) will be involved. Their salaries average approximately \$60,000 each.
- 3 faculty need approximately 1/10 of an administrative assistant.
- Lab fees for the methods and science courses are included at \$150/person.
- Tuition is estimated at \$11,000 per academic year (does not include fees) and would be divided between two colleges for the students in double majors.
- With the fees and reallocation of funds, the estimated costs balance with the sources to be income neutral.

Table G - Costs of the Program

ESTIMATED COSTS BY YEAR						
CATEGORY	1st	2nd	3rd	4th	5th	TOTALS
Program Administration	0	0	0	0	0	0
Faculty Salaries	180,000	180,000	180,000	180,000	180,000	940,000
Graduate Assistants	0	0	0	0	0	0
Clerical/Support Personnel	3,000	3,000	3,000	3,000	3,000	15,000
Supplies and Materials	150	300	450	600	600	2,100
Library Resources	0	0	0	0	0	0
Equipment	0	0	0	0	0	0
Facilities						
Other (Identify)						
TOTALS	183,150	183,300	183,450	183,600	183,600	957,100
SOURCES OF FINANCING BY YEAR						
Tuition Funding (portion of funds allocated to unit)	22,000	44,000	66,000	88,000	88,000	308,000
Program-Specific Fees (lab costs)	150	300	450	600	600	2100
Reallocation of Existing Funds* (This funding is already covering the faculty salaries. As the number of students enrolled increases, the Less needed for reallocation.)	161,000	139,000	117,000	95,000	95,000	607,000
TOTALS	183,150	183,300	183,450	183,600	183,600	957,100

*Specify significant internal sources of reallocated funds. Add additional rows as necessary.

Institutional Approval

- Teacher Education (approved, 1/14/11)
- College of Health, Education, and Human Development (approved, 2/2/11)
- Department of Physics (approved, 11/3/10)
- University Undergraduate Curriculum Committee (approved, 3/4/11)
- Clemson University Board of Trustees (approved, 1/26/2011)