

Office of the Provost

University of Maryland, Baltimore County
1000 Hilltop Circle
Baltimore, Maryland 21250

PHONE: 410-455-2333

FAX: 410-455-1107

WEB: www.umbc.edu

December 18, 2018

Karen King-Sheridan

Associate Director, Collegiate Affairs

Maryland Higher Education Commission

6 N. Liberty Street

Baltimore, MD 21201

Dear Ms. King-Sheridan, *Karen*

It has come to my attention that in development of the proposal for the new Bachelor of Science in Middle Grades STEM (submitted to MHEC on 11/12/18), some inconsistent language was used in the body of the document regarding the program's title. The correct title is B.S. in Middle Grades STEM. Thank you very much for correcting this in your records.

Sincerely,



Beth Wells

Assistant Vice Provost for Academic Affairs

Office of the Provost

University of Maryland, Baltimore County
1000 Hilltop Circle
Baltimore, Maryland 21250

PHONE: 410-455-2333

FAX: 410-455-1107

WEB: www.umbc.edu

November 9, 2018

James D. Fielder, Jr., Ph.D.

Secretary

Maryland Higher Education Commission

6 North Liberty Street

Baltimore, MD 21201

Dear Secretary Fielder:

UMBC seeks approval to offer a new Bachelor of Science in Middle Grades STEM. This is an exciting new program that addresses the Maryland State Department of Education's (MSDE) identified shortage of Mathematics and Science teachers for the Middle Grades in our state. To help address this need, MSDE has added Middle Grades as a new area of teacher certification, and UMBC seeks to address these needs in STEM, one of our identified strengths. As such, this program is unique in the State of Maryland, and it adds to UMBC's existing bachelor's programs Chemistry Education, Biology Education, and Physics Education.

Increasing the number of highly qualified STEM educators is an imperative if we are to prepare future generations of our young people with the knowledge and skills to compete in the economies of Maryland and our region.

Thank you very much for your review of UMBC's proposal. We look forward to hearing from you if you have any questions.

Sincerely,



Freeman A. Hrabowski, III

President

C Dr. Antonio Moreira, UMBC

Dr. Jonathan Singer, UMBC



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Cover Sheet for In-State Institutions New Program or Substantial Modification to Existing Program

Institution Submitting Proposal	UMBC
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Each action below requires a separate proposal and cover sheet.

- | | |
|--|--|
| <input checked="" type="radio"/> New Academic Program New
<input type="radio"/> Area of Concentration New
<input type="radio"/> Degree Level Approval New
<input type="radio"/> Stand-Alone Certificate
<input type="radio"/> Off Campus Program | <input type="radio"/> Substantial Change to a Degree Program
<input type="radio"/> Substantial Change to an Area of Concentration
<input type="radio"/> Substantial Change to a Certificate Program
<input type="radio"/> Cooperative Degree Program
<input type="radio"/> Offer Program at Regional Higher Education Center |
|--|--|

Department Proposing Program	Education	
Degree Level and Degree Type	Bachelor of Science	
Title of Proposed Program	Middle Grades STEM	
Total Number of Credits	123	
Suggested Codes	HEGIS:	CIP: 13, 1019
Program Modality	<input checked="" type="radio"/> On-campus <input type="radio"/> Distance Education (<i>fully online</i>) <input type="radio"/> Both	
Program Resources	<input checked="" type="radio"/> Using Existing Resources <input type="radio"/> Requiring New Resources	
Projected Implementation Date	<input checked="" type="radio"/> Fall <input type="radio"/> Spring <input type="radio"/> Summer Year: 2019	
Provide Link to Most Recent Academic Catalog	URL: http://catalog.umbc.edu/	

Preferred Contact for this Proposal	Name: Beth Wells
	Title: Assistant Vice Provost for Academic Affairs
	Phone: (410) 455-8907
	Email: bwells@umbc.edu

President/Chief Executive	Type Name: ERIE MAN A HRABOWSKI, III
	Signature: Date: 11/9/18
Approval/Endorsement by Governing Board	Type Name:
	Signature: _____ Date: _____

Revised 5/15/18

A. Centrality to institutional mission statement and planning priorities

The Maryland State Department of Education (MSDE) has added middle school (grades 4-9) as a new area of teacher certification. To serve the UMBC students who want to specialize in STEM education at the middle school level, the UMBC education department is proposing a new Middle School STEM Education with concentrations in mathematics and science. UMBC currently certifies undergraduate teacher candidates for early childhood, elementary, or secondary teaching and offers bachelor degrees in biology education, chemistry education, and physics education. The new degree program is designed to equip teacher candidates with the necessary knowledge, skills, and dispositions to become successful STEM teachers of young adolescent learners (grades 4 through 9). The main goal of the new program is one shared by UMBC and the Association for Middle Level Education (AMLE), which is to improve the educational experiences of young adolescents by providing vision, knowledge, and resources to all who serve and teach them.

The proposed Bachelor of Science in Middle School STEM Education reflects UMBC's mission in specific ways as described below.

"UMBC is a dynamic public research university integrating teaching, research and service to benefit the citizens of Maryland." Maryland has consistently had a shortage of qualified teachers, particularly in the critical STEM content areas. Early-career attrition, flat teacher education graduation rates, and teacher retirements are contributing factors. The proposed Bachelor of Science in Middle School STEM Education will provide a benefit to the citizens of Maryland by increasing the number of highly qualified STEM educators available to teach children and youth in the State.

"As an Honors University, the campus offers academically talented students a strong undergraduate liberal arts foundation that prepares them for graduate and professional study, entry into the workforce, and community service and leadership." According to the Maryland Teacher Staffing Report 2014-16, 23 of the state's 25 school districts have been designated as geographic shortage areas based on superintendents' inability to fulfill their staffing needs in critical content areas. Consequently, students with degrees and certification in STEM education are highly marketable within the state, and employment trends suggest that their marketability will continue into the foreseeable future. Thus, the proposed Bachelor of Science in Middle School STEM Education will further UMBC's mission to prepare its talented undergraduate students for entry into the workforce, community service, and leadership.

Moreover, the proposed degree program will advance UMBC's existing strategic goals for student learning. Specifically, UMBC seeks to strengthen its:

...[P]erformance as a research university that integrates a high-quality undergraduate education with faculty scholarship and research through a distinctive curriculum and set of experiences promoting student engagement, such as seminars, study groups, research opportunities, mentoring, advising, co-curricular learning experiences, and exposure to diversity.

The proposed Bachelor of Science in Middle School STEM Education will be unique in the state and further distinguish UMBC as an innovative institution “with a deep commitment to undergraduate education.” While Middle Grades STEM is the first bachelor’s degree initiated by the Department of Education, UMBC’s existing bachelor’s degrees in Chemistry Education, Biology Education, and Physics Education have established UMBC as degree-granting in the area of baccalaureate education in the Baltimore Metropolitan area. In addition, like all certification programs in education, the proposed degree will include specialized seminars; preK-12 classroom-based research opportunities; and field experiences and internships in diverse public schools in Baltimore City, Baltimore County, Howard County, and Anne Arundel County through the department’s network of professional development schools.

B. Critical and compelling regional or statewide need as identified in the State Plan

1. The proposed Bachelor of Science in Middle School STEM Education aligns with the goals stated in “Powering Maryland Forward”, USM’s 10-year strategic plan. One of these goals is to, “Expand baccalaureate degree production by an additional 10,000 degrees, with particular focus on the high-need areas of science, technology, engineering, and mathematics, or STEM”. The proposed bachelor’s degree will add to the number of baccalaureate degrees in STEM education subjects (e.g., biology, chemistry, and physics education) conferred at UMBC. The proposed bachelor’s degree will also help to achieve a second and related target, which is to “Triple the number of STEM teachers graduating from USM institutions”. Thus, the Bachelor of Science in Middle School STEM Education will help to meet current and future needs within the State and region.

The proposed Bachelor of Science in Middle School STEM will provide a benefit to the citizens of Maryland by increasing the number of highly qualified STEM educators available to teach children and youth in the State. In its *Maryland Teachers Staffing Report for 2016-2018*, the Maryland State Department of Education (MSDE) declared a critical shortage of teachers in Middle Grades (4-9) for both Mathematics and Science (pg. 44). There are also critical shortages in grades 7-12 in Mathematics and in these Sciences: Biology, Chemistry, Earth/Space Science, Physical Science, and Physics. The Maryland Department of Labor, Licensing and Regulations projects that between 2014 and 2024, there will be a 30% increase in the number of middle school teachers needed in Maryland (Maryland Occupational Projections - 2014-2024 - Workforce Information and Performance, online).

Students with degrees and state certification in STEM education are highly marketable within the state, and employment trends suggest that their marketability will continue into the foreseeable future. The proposed Bachelor of Science in Middle School STEM Education will further UMBC’s mission to prepare its talented undergraduate students for entry into the workforce, community service, and leadership.

2. In addition, the proposed degree, which will prepare middle school STEM teachers, aligns with priorities outlined in the Maryland State Plan for Postsecondary Education (MSPPE). Specifically, the MSPPE charges colleges and universities to “appropriately staff and support

high-needs employment areas, such as teacher education, STEM fields, and nursing, while continuing to provide a solid core foundation of skills”. The MSPPE also describes the need for undergraduate degrees that provide applied learning experiences, stating:

...[O]pportunities should be available for students to become intentional learners in diverse learning environments. An intentional learner is purposeful and sets clear goals.... Diverse learning environments include service learning, study abroad, and internships and externships that help bridge classroom lessons and real-life applications.

The proposed Bachelor of Science in Middle School STEM Education includes field experiences and a 100-day internship in diverse p-12 professional development schools in Anne Arundel County, Baltimore City, Baltimore County, and Howard County, helping students to connect theory, research, and practice.

C. Quantifiable & reliable evidence and documentation of market supply & demand in the region and State

1. In May 2017, Maryland employed 12,110 middle school teachers¹. Only approximately 41% of teachers in Maryland were prepared in Maryland². Middle School Education (Grades 4-9) mathematics and science have been declared critical shortage areas in 2016-17 and 2017-18 for Maryland². Graduates from the proposed Bachelor of Science in Middle Grades STEM education will be prepared for employment in this critical occupational growth area in the state.

3. According to the Bureau of Labor Statistics, employment of middle school teachers is projected to grow 8 percent from 2016 to 2026, about as fast as the average for all occupations. Growth is projected due to expected increases in enrollment combined with declines in student-teacher ratios. For more information regarding the field, nationally, see Appendix A.

D. Reasonableness of program duplication

1. As of today, no other institution of higher education in Maryland offers a Middle Grades STEM degree. The University of Maryland, College Park (UMCP) offers a Middle School Math and Science degree, and Towson University offers a general Middle School degree that include mathematics and science. Neither institution offers a broader, integrated STEM degree with required coursework in Math, Science, Engineering, and Technology. New education standards (e.g., Maryland College and Career Readiness Mathematical Standards, New Generation Science Standards) require that middle grade math and science teachers have an in-depth understanding of all four STEM content areas so that they can engage students in meaningful,

¹ Bureau of Labor Statistics. (2017). *Occupational employment statistics: Occupational employment and wages, May 2017*. <https://www.bls.gov/oes/current/oes252022.htm#nat>

² Maryland State Department of Education. (2016). Maryland teacher staffing report: 2016-2018. <http://www.marylandpublicschools.org/about/Documents/DEE/ProgramApproval/MarylandTeacherStaffingReport20162018.pdf>

inquiry driven instruction. The proposed program was designed to meet these new standards in mathematics and science.

The proposed Bachelor of Science in Middle School STEM Education will be unique in the state and further distinguish UMBC as an innovative institution with a deep commitment to undergraduate education.

2. The UMBC Bachelor of Science in Middle Grades STEM Education will provide students with a unique opportunity to develop an integrated understanding of math, science, engineering and technology. Building on UMBC’s reputation in STEM, the education department will be the first in the state to offer such a program. Thus, graduates will be prepared to fill two of the State’s critical needs in p-12 education – highly qualified middle school teachers, and highly qualified STEM teachers.

E. Relevance to implementation or maintenance of high-demand programs at Historically Black Institutions (HBIs)

1. Currently, no HBI in the state offers a Bachelor’s degree in Middle Grades STEM, in any subject area for middle grades, or explicitly in integrated STEM education. There is therefore no anticipated negative impact on programs offered by HBIs.

2. Relevance to the Support of the Uniqueness and Institutional Identities of HBIs
The proposed bachelor’s degree in Middle Grades STEM Education has the potential to produce students for advanced degree programs in STEM related fields at two Maryland HBIs –Bowie State University and Morgan State University.

F. Relevance to the support of the uniqueness and institutional identities of HBI’s

The proposed BS in Middle Grades STEM Education will prepare teacher candidates to be strong STEM teacher leaders. Graduates from the program will be well-positioned to enter advanced degree programs in educational leadership, many of which are offered by HBIs in Maryland. We will actively encourage students interested in pursuing advanced degrees to consider the programs offered by HBIs. To begin this process, we have compiled a list of relevant advanced programs and degrees from Maryland HBIs. Our program website will include this information along with links to the HBI programs.

HBI	Program	Degree
Bowie State University	Educational Leadership	Ed.D.
	Elementary & Secondary School Administration	M.Ed.
	Special Education	M.Ed.
Morgan State University	Educational Administration and Supervision	M.S.
	Mathematics Education	Ed.D.
	Science Education	Ed.D.
	Urban Educational Leadership	Ed.D.
Coppin State University	Special Education	M.Ed.

HBI	Program	Degree
	Curriculum & Instruction	M.Ed.
University of Maryland Eastern Shore	Special Education	M.Ed.
	Education Leadership	Ed.D.

G. Adequacy of Curriculum Design and Delivery to Related Learning Outcomes

1. The Association for Middle Level Education (AMLE) and Maryland State Department of Education (MSDE) require that middle school educators have specialized strength in a content area. The proposed content area for specialization is STEM. The courses in the curriculum will be a combination of middle level education courses (41 credits), STEM content courses (57 or 58 credits), and UMBC general education courses (GEPs; 25 credits), shown in Table 1.

Table 1. List of Courses and Credits

Course Number and Title	Credits
Education Major Requirements	41
EDUC310 Inquiry into Education (Social Science GEP)	3
EDUC311 Psychological Foundations of Education (Social Science GEP)	3
EDUC388 Inclusion and Instruction	3
EDUC410 Reading in the Content Area I	3
EDUC411 Reading in the Content Area II (Writing Intensive GEP)	3
EDUC412M Introduction to Middle Level Teaching and Learning	3
EDUC431 Methods for Teaching STEM in The Middle Grades	3
EDUC435 Integrated STEM Content and Pedagogy	3
EDUC466 School, Family, and Community Partnerships for Middle Grades STEM Success	3
EDUC454 Phase I Seminar	2
EDUC456 Phase II Internship	10
EDUC457 Phase II Seminar	2
STEM Content Courses	57 or 58
MATH 131 Mathematics for Elementary School Teachers I	4
MATH 132 -Mathematics for Elementary School Teachers II	4
MATH 155 Applied Calculus OR MATH 151 – Calculus and Analytic Geometry I	4
STAT 350 Statistics with Applications in the Biological Sciences OR STAT 355 Introduction to Probability and Statistics for Scientists and Engineers	4
BIOL 141 Foundations of Biology: Cells, Energy, and Organisms	4
BIOL 142 -Foundations of Biology: Ecology and Evolution	4
BIOL 300L Experimental Biology Laboratory	2
BIOL 302 Molecular and General Genetics	4
GES110 Physical Geography	3
CMSC 104 Problem Solving and Computer Programming OR CMSC 201 – Computer Science I	3 OR 4
CHEM101 Principles of Chemistry I	4
CHEM102 Principles of Chemistry II	4

Course Number and Title	Credits
CHEM102L-Introductory Chemistry Lab I	2
PHYS111 Basic Physics I	4
PHYS112 Basic Physics II	4
ENES101-Introduction to Engineering	3
Additional General Education Program (GEP) Requirements	25
Composition (Recommended: ENGL100 Composition)	3
Foreign Language 201	4
Social Science (Recommended: GES 326 American Conservation Thought)	3
Arts & Humanities (Recommended: PHIL251 – Ethical Issues in Science and Engineering)	3
Arts & Humanities (Recommended: AMST200 What is an American?)	3
Arts & Humanities (Recommended: THTR 242 Presentation Skills for Non-Actors)	3
Culture (Recommended: GES 102 Human Geography)	3
2 Physical Education	3

2. All the courses included in the curriculum will provide candidates with the knowledge, skills, and dispositions to be successful middle school STEM teachers in diverse settings, following standards established by the Association for Middle Level Education. Moreover, students will be prepared for teacher certification in middle grades science and mathematics, making them uniquely marketable in the state and region (See Appendix B for a description of courses required for the degree).

3. As part of an honors university experience, students will be introduced to the richness and diversity of the various academic disciplines through general education requirements. Specifically, they will be required to take a single language through the 201- level or equivalent proficiency; three social science courses; three arts and humanities courses; and one cultural studies course in addition to their coursework in mathematics, science, engineering, technology, and education.

4. Students will be required to take 123 credits to complete the program. The sequence of courses is based on an integration of theory and practice, and includes field experiences as well as an internship in a professional development middle school that will extend for two consecutive semesters at the end of the program. The four-year plan of study will include courses aligned with accreditation standards established by the Council for Accreditation of Educator Preparation (CAEP), AMLE, and MSDE. Successful completion of all course work including the two-semester internship will be required for Maryland teaching certification. (See degree program plan in Appendix C.)

H. Adequacy of any articulation

No articulation agreements with other institutions are required for this degree.

I. Adequacy of faculty resources

Over 90% of the education courses in this degree will be taught by full-time faculty; and over 80% will be taught by full-time faculty with doctoral degrees and extensive experience in the course content they will teach. Moreover, 50% of the education courses will be taught by tenured or tenure-track faculty. The faculty's areas of expertise reflect the competencies that students will be expected to demonstrate upon completion of the degree. See Appendix D for a description of faculty characteristics.

Four full-time, tenure-track education faculty will allocate 20% of their effort to assist with the implementation of the new degree, shown as .8 FTE in Appendix F. To complement their efforts, a new faculty member with specific research and teaching expertise in middle grades education will be hired in the second year of the program. The Expenditure Table in Appendix F shows the costs of salary and benefits for the new faculty hire. In Year 2, the category "Other Expenses" includes costs for a start-up package for the new hire.

J. Adequacy of library resources

The President assures that appropriate library resources are available to support the needs of this program.

K. Adequacy of physical facilities, infrastructure and instructional equipment (as outlined in COMAR 13B.02.03.13)

The President assures that appropriate physical facilities, infrastructure, and instructional equipment are available to support the needs of this program.

L. Adequacy of financial resources with documentation (as outlined in COMAR 13B.02.03.14)

The President assures that no new general funds from the State are required. The University will incur additional costs for instructors to teach extra sections, as needed, of content courses in the College of Arts, Humanities, and Social Sciences, the College of Engineering and Information Technology, and the College of Natural and Mathematical Sciences. Expenditures will also include costs for adjunct faculty in education to teach courses for the middle grades degree. Expenses will also include equipment, and library costs. These new expenditures will increase as student enrollment in the new degree program increases (see Expenditure Table in Appendix F). However, these expenditures are not outside the normal costs associated with new bachelor's degrees in STEM.

M. Adequacy of provisions for evaluation of program consistent with Regulation .15 in COMAR

Faculty Evaluation: All tenured faculty are reviewed each year during the Spring Semester by the department chair or program head using the Faculty Annual Report. Student Course Evaluation Questionnaires (SCEQs) from the previous two semesters may be included. The general criteria for the Annual Review of tenured faculty include those used for workload and merit pay reviews and are consistent with the departmental statement of Performance

Expectations. A comprehensive review of faculty occurs every five years using the components involved for promotion and tenure processes. A favorable review for promotion in rank substitutes for this review.”

Academic Program Review: Each UMBC program undergoes an academic program review every seven years, the purpose of which is to assess and improve the quality of the program. Following the self-study and visit by external reviewers, an action plan for continuing to enhance the quality of the program is developed and implemented by the chair and senior management, with review by UMBC’s faculty governance committees.”

Program and Institutional Level Evaluation: The 2009 UMBC Assessment Plan delineates roles and responsibilities for learning assessment. The plan requires that academic programs collect data and provide assessment reports to their respective College Deans every two years. The Deans summarize findings in a report that is shared with the Council of Deans. Representatives of the General Education Committee (GEC) join this meeting with the purpose of determining how well the University is assessing and achieving its institutional-level student learning outcomes. The GEC develops a report that captures highlights and proposes recommendations for improvement. The University Assessment Committee, which includes stakeholders across the University, then reviews these reports. Achievements are noted and recommendations made for moving forward.

In addition, the department has instituted a regular and systematic method to evaluate students’ learning outcomes as required by the Maryland State Department of Education (MSDE), Council on Accreditation of Education Programs (CAEP), and certification-specific Specialized Professional Associations (SPAs). These organizations require the department to collect and use evidence of student learning outcomes to confirm and improve students’ educational experiences and outcomes. The SPA that oversees middle grades education is the Association of Middle Level Education (AMLE). AMLE will require the department to assess students’ learning and progress within the proposed bachelor’s degree program according to its professional standards. AMLE program approval is required for MSDE and CAEP certification. See Appendix G for a description of courses and related AMLE standards.

N. Consistency with the State’s minority student achievement goals

UMBC has established a commitment to diversity as one of the core principles guiding its recruitment and retention of faculty, staff, and students. The department is committed to recruiting and graduating students that reflect the diversity of Maryland’s p-12 public schools, which includes White (42.5%), African American (35.4%), Latino (12.1%), Asian (5.9%), and American Indian/Native Alaskan (4.1%) students from diverse socioeconomic backgrounds. To support the department’s efforts, scholarships will be provided through the Sherman STEM Scholars Program and the Noyce Teacher Scholars program to students who commit to teaching in high-needs schools.

O. Relationship to low productivity programs identified by the Commission:

The proposed degree has no relationship to a low productivity program.

P. If proposing a distance education program, please provide evidence of the Principles of Good Practice.

No distance learning is included.

Appendix A: Employment Data for Middle Grades Teachers

Quick Facts: Middle School Teachers	
<u>2017 Median Pay</u>	\$57,720 per year
<u>Entry-Level Education</u>	Bachelor's degree
<u>Work Experience in a Related Occupation</u>	None
<u>On-the-job Training</u>	None
<u>Number of Jobs, 2016</u>	630,300
<u>Job Outlook, 2016-26</u>	8% (As fast as average)
<u>Employment Change, 2016-26</u>	47,300

Appendix B. Full Description of Courses for Middle Grades STEM Degree

Course Number and Title	Credits
Education Major Requirements (41 credits)	
<p>EDUC310 Inquiry into Education This course introduces reflective practice as a foundation for the study of teaching and learning. The macro- and micro-sociocultural contexts of education across diverse settings will be examined. Students will draw upon anthropological and sociological research methods to study the dynamics of classrooms, schools and communities. (Social Science GEP)</p>	3
<p>EDUC311 Psychological Foundations of Education The psychology of school learning will be explored. There will be an overview of theories of teaching, learning, motivation and related research, including the philosophical assumptions underlying each - within the dynamics of context of class, culture, race and gender issues. (Social Science GEP)</p>	3
<p>EDUC388 Inclusion and Instruction The course examines the legal, philosophical and programmatic underpinnings of instructional inclusion, broadly defined.</p>	3
<p>EDUC410 Reading in the Content Area I Major approaches to teaching reading to students in grades 7 to 12. Emphasis on skills in all content areas ranging from English to science, which the secondary teacher can apply toward improving secondary students' reading ability and their attitude toward reading.</p>	3
<p>EDUC411 Reading in the Content Area II (Writing Intensive) This course is designed to develop competency in the utilization of reading and writing strategies, assessments, vocabulary building, comprehension, and special-needs adaptations.</p>	3
<p>EDUC412M Introduction to Middle Level Teaching and Learning This course is an introduction to a systematic approach to instruction for middle grades (4-9). Special emphasis is placed on formal lesson plan development, use of research-supported strategies, and methods of differentiation. The use of technology resources in instructional planning is emphasized. Students will develop skills to create meaningful learning experiences for students of diverse cultural, ethnic, linguistic and intellectual backgrounds. These skills are then practiced in actual peer teaching situations that may occur off campus.</p>	3
<p>EDUC466 School, Family, and Community Partnerships for Middle Grades STEM Success Students examine the theory, research, and best practices on school, family, and community partnerships, with a particular emphasis on strategies to support young adolescents' success in STEM subject areas.</p>	3
<p>EDUC435 Integrated STEM Content and Pedagogy Students will review the integrated approaches to teaching Science, Technology, Engineering, and Mathematics (STEM). Integrated STEM pedagogies include project/problem-based (PBL), design-based, and inquiry-based approaches to teaching.</p>	3

Course Number and Title	Credits
<p>EDUC431 Methods for Teaching STEM in The Middle Grades This course introduces pedagogical practices associated with the teaching and learning of integrated STEM practices at the middle levels. The course addresses ideas that include (1) middle grades science, mathematics, engineering and technology (STEM) content, (2) understanding and developing middle grades students' thinking; (3) designing, selecting, and sequencing instructional tasks and assessments for learners in the middle grades; and (4) self-reflection on learning and teaching STEM at the middle school level.</p>	3
<p>EDUC454 Phase I Seminar This seminar course provides a forum for discussing and processing Phase I Internship experiences and current topics/issues/trends in STEM teaching and learning.</p>	2
<p>EDUC456 Phase II Internship This intensive internship provides students with the opportunity to take progressive responsibility for teaching in their specialty area and developing professional teaching competencies in a Professional Development School with support from a mentor teacher and a university supervisor.</p>	10
<p>EDUC457 Phase II Seminar The seminar provides a forum for discussing and processing field experiences and current issues/problems in teaching and learning.</p>	2
STEM Content Courses (57 credits)	
<p>MATH 131 - Mathematics for Elementary School Teachers I Intended primarily for prospective elementary school teachers. Structural aspects of mathematics and the 'why' of arithmetical computations. Topics include sets, functions, logic, numbers and number systems, numeration systems, properties of mathematical operations, techniques for computation, decimals, elementary number theory, metric and non-metric geometry, elements of probability and statistics.</p>	4
<p>MATH 132 -Mathematics for Elementary School Teachers II A continuation of MATH132</p>	4
<p>MATH 155 - Applied Calculus Basic ideas of differential and integral calculus, with emphasis on elementary techniques of differentiation and integration with applications, are treated in this course. OR MATH 151 – Calculus and Analytic Geometry I Topics of this course include limits, continuity, the rate of change, derivatives, differentiation formulas for algebraic, trigonometric, logarithmic, and exponential functions, maxima and minima, integration and computation of areas, the Fundamental Theorem of Calculus, areas and volumes of solids of revolution, and applications.</p>	4

Course Number and Title	Credits
<p>STAT 350 - Statistics with Applications in the Biological Sciences Organization and presentation of data, summary of descriptive measures, probability, binomial and normal distributions, sampling natural populations and the estimation of population parameters, hypothesis testing, chi-square analysis experimental designs and the analysis of variance, linear regression and correlation, and nonparametric statistics. Students will be introduced to statistical computing. All the statistical procedures will be illustrated using data from biology and the health sciences.</p> <p>OR</p> <p>STAT 355 - Introduction to Probability and Statistics for Scientists and Engineers An introduction to applied statistics designed for science majors and others with demonstrated quantitative ability. Topics include nature of statistical methods, random variables and their distribution functions, general principles of estimation and hypothesis testing. A laboratory introduces students to computer techniques in statistical analysis.</p>	4
<p>BIOL 141 - Foundations of Biology: Cells, Energy, and Organisms This course for majors provides a broad overview of contemporary biological concepts.</p>	4
<p>BIOL 142 -Foundations of Biology: Ecology and Evolution This course provides a broad overview of contemporary biological concepts. It is designed to prepare students for upper level biology core and elective courses. It is one of two introductory courses.</p>	4
<p>BIOL 300L - Experimental Biology Laboratory An upper level course of experiments designed to give students the essential laboratory and critical thinking skills in experimental design, implementation and analysis that every biologist should know.</p>	2
<p>BIOL 302 - Molecular and General Genetics Modern principles of heredity have been established through studies at the molecular, cellular and organismic levels. This course explores the fundamental biology of gene structure, organization, expression, and function as deduced from analyses of viral, prokaryotic, and eukaryotic systems and the gene interactions that underlie them.</p>	4
<p>GES 110 - Physical Geography Study of the principles and processes of climate, earth materials, landforms, soils and vegetation that give logic to their integrated patterns of world distribution.</p>	3
<p>CMSC 104 - Problem Solving and Computer Programming This course is designed to provide an introduction to problem solving and computer programming that does not require prior programming experience.</p> <p>OR</p> <p>CMSC 201 – Computer Science I for Majors An introduction to computer science through problem solving and computer programming. Programming techniques covered by this course include modularity, abstraction, top-down design, specifications documentation, debugging and testing. The core material for this course includes control structures, functions, lists, strings, abstract data types, file I/O, and recursion.</p>	3
<p>CHEM 101 - Principles of Chemistry I An introduction to chemistry for science majors and other students who require a thorough grounding in the principles of chemistry.</p>	4
<p>CHEM 102 - Principles of Chemistry II Principles of chemical and physical equilibrium, liquids and solids, elementary thermodynamics, electron and proton transfer reactions, electrochemistry, chemical kinetics and a further study of the periodic properties of the elements.</p>	4

Course Number and Title	Credits
CHEM 102L-Introductory Chemistry Lab I A laboratory course designed to illustrate fundamental genetic principles by experimentation.	2
PHYS 111 Basic Physics I Three lectures and one two-hour laboratory period a week. A general physics course intended primarily for students in psychology, biology and health related sciences.	4
PHYS 112 Basic Physics II Continuation of PHYS 111. Topics include electricity, magnetism, optics and modern physics.	4
ENES 101-Introduction to Engineering Introduction to engineering that covers dimensional analysis, data analysis, professional practice, and an introduction to engineering subjects such as statics, heat transfer, and linear circuits.	3
Additional General Education Program Requirements (25 credits)	
Composition (Recommended: ENGL100 Composition) ENGL100 Composition A course in critical thinking, reading, and composing, with an emphasis on integrating academic research and documentation.	3
Foreign Language 201	4
Social Science (Recommended: GES 326 American Conservation Thought) GES 326 American Conservation Thought An exploration of the major ideas and events of American conservation history from European colonization through to the modern environmental movement. The course focuses upon changing attitudes towards nature, wildlife, and natural resources and also covers the evolution of federal policy regarding the establishment and management of national parks, forests and wilderness areas. In addition, we will review and analyze some of the major environmental and resource controversies of the last 100 years.	3
Arts & Humanities (Recommended: AMST200 What is an American?) AMST200 What is an American? This course will explore the evolving question of what constitutes American identity and belonging through important readings on race, class, ethnicity, religion, immigration, gender, sexuality, freedom, and equality.	3
Arts & Humanities (Recommended: PHIL251 Ethical Issues in Science and Engineering) PHIL251 – Ethical Issues in Science and Engineering The primary focus of the course will be inquiry into the ethical responsibilities of scientists, engineers and information technologists in today's high-tech, information-oriented society.	3
Arts & Humanities (Recommended: THTR242 – Presentation Skills for Non-Actors) THTR242 – Presentation Skills for Non-Actors An introduction to theatre performance skills that can be applied to public presentations. Emphasis is placed on developing greater expressiveness through the study of a range of acting, voice and movement techniques. Students will make presentations in class as they explore the relationship of the speaker/performer to the listener/ audience.	3
Culture (Recommended: GES 102 Human Geography) GES 102 Human Geography Study of the distribution of human activities and the causes and consequences of these distributions, including population, resources, economic activity, urban and rural settlements and cultural phenomena.	3

Course Number and Title	Credits
Physical Education (2 courses required)	3

Appendix C - Course Plan for Middle Grades STEM Degree – 123 credits

Year 1

Fall	Credits	Spring	Credits
ENGL GEP (Recommended ENGL 100 Composition)	3	AH GEP (Recommended: PHIL 251 Ethical Issues in Science and Engineering)	3
C GEP (Recommended: GES 102 Human Geography)	3	EDUC 310 Inquiry into Education (SS GEP)	3
MATH 131 Mathematics for Elementary School Teachers I	4	MATH 132 Mathematics for Elementary School Teachers II	4
BIOL 141 Foundations of Biology: Cells, Energy, and Organisms	4	BIOL 142 Foundations of Biology: Ecology and Evolution	4
		CMSC 104 Problem Solving and Computer Programming OR	3 OR 4
		CMSC 201 Computer Science I	
Total Credits	14	Total Credits	17-18

Year 2

Fall	Credits	Spring	Credits
EDUC 311 Psychological Foundations of Education (SS GEP)	3	AH GEP (Recommended: AMST 200 What is an American?)	3
EDUC 388 Inclusion and Instruction	3	AH GEP (Recommended: THTR 242 Presentation Skills for Non-Actors)	3
Language 201	4	EDUC 412M Intro to Middle Level Teaching and Learning	3
MATH 155 Applied Calculus OR	4	GES 110 Physical Geography	3
MATH 151 Calculus & Analytic Geometry I	4	CHEM 102 Principles of Chemistry II	4
CHEM 101 Principles of Chemistry I	4	CHEM 102L Introductory Chemistry Lab I	2
Total Credits	18	Total Credits	18

Year 3

Fall	Credits	Spring	Credits
PHYS 111 Basic Physics I	4	EDUC 410 Reading in the Content Area I	3
ENES 101 Introduction to Engineering	3	EDUC 435 Integrated STEM Content and Pedagogy	3
STAT 350 Statistics with Applications in the Biological Sciences OR	4	BIOL 302 Molecular and General Genetics	4
STAT 355 Introduction to Probability and Statistics for Scientists and Engineers	4		
BIOL 300L Experimental Biology Laboratory	2	PHYS 112 Basic Physics II	4
EDUC 466 School, Family, and Community Partnerships for Middle Grades STEM Success	3	PE GEP	1.5
Total Credits	16	Total Credits	15.5

Year 4

Fall	Credits	Spring	Credits
EDUC 411 Reading in the Content Area II (WI GEP)	3	EDUC 456 Phase II Internship	10
EDUC 431 Methods for Teaching STEM in the Middle Grades	3	EDUC 457 Phase II Seminar	2
EDUC 454 Phase I Seminar	2		
SS GEP (Recommended: GES 326 American Conservation Thought)	3		
PE GEP	1.5		
Total Credits	12.5	Total Credits	12

Appendix D. Faculty Resources

Name	Appt. Type	Highest Degree	Field	Academic Title/Rank	Status (e.g., full-time, part-time, adjunct)	Course(s) Taught
Nancy Berge	Non-tenure track	MA	Special Education	Instructor	Adjunct	EDUC388
Susan Blunck	Non-tenure track	PhD	STEM Education; Middle Grades Education	Assoc. Clinical Prof.	Full Time	EDUC454
Tracy Irish	Non-tenure track	PhD	STEM Education; Professional Learning Communities	Clinical Instructor	Full Time	EDUC430
Cheryl North	Non-tenure track	PhD	Literacy; Secondary Education	Assist. Clinical Prof.	Full Time	EDUC410, EDUC 411
Linda Oliva	Non-tenure track	EdD	Educational Psychology; Instructional Technology; Teacher Research	Assist. Clinical Prof.	Full Time	EDUC311
Christopher Rakes	Tenure - track	PhD	Mathematics Education	Assist. Prof.	Full Time	EDUC412M
Mavis Sanders	Tenured	PhD	School, Family, Community Partnerships; Cultural Diversity; School Reform	Prof.	Full Time	EDUC466
Eugene Schaffer	Tenured	EdD	Mentoring; School Effectiveness; Prof. Dev. Schools; At-Risk Youth	Prof.	Full Time	EDUC310
Jonathan Singer	Tenured	PhD	Science Education	Assoc. Prof.	Full Time	EDUC431; EDUC456; EDUC 457
Michele Stites	Tenure-track	EdD	Special Education; Early Childhood Edu.	Assistant Professor	Full Time	EDUC388
New Faculty	Tenure-track	PhD/EdD	Middle Grades Education	Open	Full Time	EDUC431; EDUC412

Appendix E: Resources Table

Resources Categories	(Year 1)	(Year 2)	(Year 3)	(Year 4)	(Year 5)
1. Reallocated Funds	0	0	0	0	0
2. Tuition/Fee Revenue (c+g below)	130350	307258	460551	586500	660790
a. #F.T Students	15	34	49	60	65
b. Annual Tuition/Fee Rate ³	8690	9037	9399	9775	10166
c. Annual Full Time Revenue (a x b)	130350	307258	460551	586500	660790
d. # Part Time Students	0	0	0	0	0
e. Credit Hour Rate	0	0	0	0	0
f. Annual Credit Hours	0	0	0	0	0
g. Total Part Time Revenue (d x e x f)	0	0	0	0	0
3. Grants, Contracts, & Other External Sources³	0	0	0	0	0
4. Other Sources	0	0	0	0	0
TOTAL (Add 1 - 4)	130350	307258	460551	586500	660790

³ This rate includes the average UMBC tuition reduction of .27.

Appendix F. Expenditures Table

Expenditure Categories	(Year 1)	(Year 2)	(Year 3)	(Year 4)	(Year 5)
1. Total Faculty Expenses⁴ (b + c below)	18296	130790	155055	180667	207685
a. # FTE	0.8	1.8	1.8	1.8	1.8
b. Total Salary	12258	95253	111815	129292	147724
c. Total Benefits	6038	35537	43240	51375	59961
2. Total Administrative Staff Expenses (b + c below)⁵	27598	28701	29849	31044	32286
a. # FTE	0.5	0.5	0.5	0.5	0.5
b. Total Salary	20750	21580	22443	23341	24275
c. Total Benefits	6848	7121	7406	7703	8011
3. Total Support Staff Expenses (b + c below)	0	0	0	0	0
a. # FTE	0	0	0	0	0
b. Total Salary	0	0	0	0	0
c. Total Benefits	0	0	0	0	0
4. Equipment⁶	15000	15450	15914	16391	16883
5. Library⁷	3000	3180	3371	3573	3787
6. New or Renovated Space	0	0	0	0	0
7. Other Expenses⁸	63424	165432⁹	228166	297267	361888
TOTAL (Add 1 - 7)	127318	343553	432355	528942	622529

⁴ This number includes .8 faculty effort (four full-time, tenure-track education faculty who are involved in the implementation of the new degree at .20 salary and fringe). This number also includes the salary and benefits for a new tenure track faculty member with teaching and research expertise in middle grades STEM education for years 2-5.

⁵ This number represents the salary and benefits for a .5 FTE staff person to assist with the administration of the new degree program.

⁶ This number includes costs for marketing, printing, computers, and instructional equipment.

⁷ This number represents costs for library books and journals with a middle grades STEM focus.

⁸ This number includes costs for part-time instructors to teach additional sections of 100-level lecture courses in the College of Arts, Humanities, and Social Sciences (CAHSS), the College of Engineering and Information Technology (COEIT), and the College of Natural and Mathematical Sciences (CNMS); as well as salaries for part-time instructors in Education.

⁹ This number includes a start-up package of \$20,000 for the new faculty member.