

Standards for the Preparation of Teachers

Biology (DA)



Adopted by the Michigan State Board of Education
August 8, 2002

Standards for the Preparation of Teachers of Biology (DA Endorsement)

Preface

Development of the Proposal

Over the last several years, a referent group of professional educators developed a proposal to adopt standards for the preparation of biology teachers. These standards align with standards developed by the National Science Teachers Association and the Michigan Curriculum Framework for science education. Teachers who receive the endorsement in biology would be prepared to teach any biology or life science course at their certificate level.

To provide information and gather feedback on the proposal, a copy was also forwarded to selected groups/organizations, all Michigan teacher preparation institutions, and a random sample of intermediate and local school districts for review and comment. As presented in this document, the standards reflect the feedback received.

State Board adoption of these standards typically leads to the creation of a new certification test for teachers prepared to teach this content area. Test development for a new Michigan Test for Teacher Certification in biology will be scheduled according to the recommendation of the Standing Technical Advisory Council.

Approval of Programs

Teacher preparation institutions that wish to continue to offer programs to prepare biology teachers are required to submit an application for program approval that demonstrates how the new standards are met throughout the proposed curriculum. The programs must be re-approved to show compliance with the new standards. Following initial approval, the teacher preparation programs will be reviewed every five years through the Periodic Review/Program Evaluation process.

Content Guidelines/Standards Matrix

College/University The University of Detroit Mercy **Code** DA

Source of Guidelines/Standards Michigan State Board of Education, August 2002 **Program/Subject Area** Biology

Levels of proficiency are identified as follows:

A – Awareness

The biology teacher recognizes/recalls the existence of different aspects of biological science and related teaching strategies.

B – Basic Understanding

The biology teacher articulates knowledge about biological science and related instructional and assessment strategies. The biology teacher demonstrates proficiency in using the knowledge at a fundamental level of competence acceptable for teaching.

C – Comprehensive Understanding

The biology teacher is able to apply broad, in-depth knowledge of the different aspects of biological science in a variety of settings. (This level is not intended to reflect mastery; all teachers are expected to be lifelong learners.)

DIRECTIONS: List required courses on matrix and provide additional narrative to explain how standards are met. If electives are included, they should be clearly indicated. Adjust size of cells as needed.

		Narrative Explaining how Required Courses and/or Experiences Fulfill the Standards for Program	
No.	STANDARD/GUIDELINE		
	Submit a narrative that explains how this program:		
A.	uses the Michigan Curriculum Framework K-12 Science Content Standards and Benchmarks as the critical foundation for teacher preparation, ensuring that Biology teachers have the content knowledge and the ability to teach this curriculum; and	<p>Secondary Minor: BIO 103 Environmental Science; BIO 120/121 General Biology I lecture/lab; BIO 122/123 General Biology II lecture/lab. One of BIO 420 Evolution+ or BIO 270 Genetics or BIO 375 Human Genetics or BIO 448/449 Ecology lecture/lab or BIO 421/422 Microbiology lecture/lab or BIO 474/475 Cell & Molecular Biology lecture/lab or BIO 451/452 Plant form & function lecture/lab.</p> <p>TOTAL REQUIRED 22 credits including 6 credits of lab.</p> <p>The above course design was specifically selected to provide students with the necessary diversity to provide them with proficiency within the field of biology, as well as provide flexibility to allow students to choose specific areas of interest or expertise.</p> <p>Education students are introduced to the <i>Michigan Curriculum Framework K-12 Science Content Standards and Benchmarks</i> in EDU 401/402 Introduction to Elementary and Secondary Education. Throughout the semester, the Secondary Teacher Education students observe in a 9-12 grade classroom of the major and/or minor for which they are considering certification. They conduct a field study and write up their findings as a case study. Education courses require students to use the appropriate <i>MCF</i> standards to complete projects, papers, unit and lesson plans. Candidates with a Biology minor will enhance their knowledge of science standards in <i>MCF</i> in EDU 469 Curriculum and Methods of Teaching in Middle and Secondary Schools. The course is designed to increase students' repertoires of instructional strategies. Among the assignments, students are required to create lessons using the appropriate <i>MCF</i> standards and benchmarks. The directions and assessment rubrics require exact <i>MCF</i> references. Additional opportunities for Biology minors to work with the <i>MCF</i> occur in EDU 475 Curriculum and Methods of Teaching in Middle and Secondary Schools II: Science. Students write papers, make presentations, and create projects, units and lesson plans that must reference the appropriate <i>MCF</i> sections. During Student Teaching, EDU 490 Student Teaching in the Secondary Schools, students are expected to work with the secondary school's curriculum and present lessons designed to help secondary students learn the concepts and skills required for them in the <i>MCF</i>.</p>	

001111 1		Narrative Explaining how Required Courses and/or Experiences Fulfill the Standards for Program
NO.	Standard/Guideline	
A (cont.)	uses the Michigan Curriculum Framework K-12 Science Content Standards and Benchmarks as the critical foundation for teacher preparation, ensuring that Biology teachers have the content knowledge and the ability to teach this curriculum; and	<p>Secondary Major:</p> <p>BIO 120/121, BIO 122/123, BIO 499. BIO 260/261 or BIO 463/464, and BIO 451/452. BIO 420 or BIO 270 or BIO 375, and BIO 448/449 or BIO 421/422 or BIO 474/475. TOTAL REQUIRED 34 including 6 credits of lab.</p> <p>The above course design was specifically selected to provide students with the necessary diversity to provide them with proficiency within the field of biology, as well as provide flexibility to allow students to choose specific areas of interest or expertise.</p> <p>Education students are introduced to the <i>Michigan Curriculum Framework K-12 Science Content Standards and Benchmarks</i> in EDU 401/402 Introduction to Elementary and Secondary Education. Throughout the semester, the Secondary Teacher Education students observe in a 9-12 grade classroom of the major and/or minor for which they are considering certification. They conduct a field study and write up their findings as a case study. Education courses require students to use the appropriate <i>MCF</i> standards to complete projects, papers, unit and lesson plans. Candidates with a Biology minor or major will enhance their knowledge of science standards in <i>MCF</i> in EDU 469 Curriculum and Methods of Teaching in Middle and Secondary Schools. The course is designed to increase students' repertoires of instructional strategies. Among the assignments, students are required to create lessons using the appropriate <i>MCF</i> standards and benchmarks. The directions and assessment rubrics require exact <i>MCF</i> references. Additional opportunities for Biology majors to work with the <i>MCF</i> occur in EDU 475 Curriculum and Methods of Teaching in Middle and Secondary Schools II: Science. Students write papers, make presentations, and create projects, units and lesson plans that must reference the appropriate <i>MCF</i> sections. During Student Teaching, EDU 490 Student Teaching in the Secondary Schools, students are expected to work with the secondary school's curriculum and present lessons designed to help secondary students learn the concepts and skills required for them in the <i>MCF</i>.</p>

Narrative Explaining how Required Courses and/or Experiences Fulfill the Standards for Program			
NO.	Standard/Guideline	Secondary Minor	Secondary Major
B.	develops an understanding of the interconnectedness of all science, including the major concepts of chemistry, the earth/space sciences, and physics, and relates this understanding to the teaching of biology and the life sciences.	<p>Supportive courses:</p> <p>CHM 107/110 & CHM 108/111, General Chemistry I & II lecture/lab. CHM 227/228 Organic Chemistry I lecture/lab.</p> <p>The courses listed above, especially those above the 100-level, are interwoven with connections between the sciences, and to the relevance of the subject matter to everyday life. Higher level courses routinely involve at least one presentation by students to their peers and the teaching faculty member.</p> <p>As discussed in Section A, the students continue to demonstrate their understanding of the <i>MCF</i> standards and benchmarks in their sequence of Education courses, especially in EDU 401.402, 469, 475, and during their student teaching.</p>	<p>Supportive Courses:</p> <p>CHM 107/110, CHM 108/111, CHM 227/228, MTH 140 Elementary Functions, BIO 290 Biometric lecture. Discovery based exposure to the statistic science related to biology. PHY 130/131 General Physics I lecture/lab, PHY 132/133 General Physics II lecture/lab.</p> <p>The courses listed above, especially those above the 100-level, are interwoven with connections between the sciences, and to the relevance of the subject matter to everyday life. Higher level courses routinely involve at least one presentation by students to their peers and the teaching faculty member.</p> <p>As discussed in Section A, the students continue to demonstrate their understanding of the <i>MCF</i> standards and benchmarks in their sequence of Education courses, especially in EDU 401.402, 469, 475, and during their student teaching.</p>

			Narrative Explaining How Required Course and/or Experiences Fulfill the Standards for Program	
No.	Standard/Guideline	Level of Proficiency	Secondary Minor	Secondary Minor
1.0	understand the life sciences to include cellular functioning, the organization of living things, concepts of heredity, evolutionary changes, and ecological systems, as illuminated within Strand III of the Science Content Standards and Benchmarks found in the Michigan Curriculum Framework;		<p>BIO 103 Environmental Science. Topic-oriented course examining interrelated problems of population, food supply and demand, pollution, and water resources;</p> <p>BIO 120/121 General Biology I lecture/lab. Emphasis on structure/function at a molecular level via analysis of basic principles, demonstrations and research orientation.</p> <p>BIO 122/123 General Biology II lecture/lab; Continuation of BIO 120/121 focusing on the organismal and environmental levels;</p> <p>BIO 451/452 Plant form & function lecture/lab. Explores diversity of plant kingdom's diversity of anatomy and physiology, such as photosynthesis, water relations, morphogenesis, growth, and taxonomy via demonstrations, research and discovery based labs; (BIO 420 or BIO 448/449)</p> <p>BIO 420 Evolution. Lecture/discussion of organic evolution via examination of driving forces for evolution that cause biodiversity;</p> <p>BIO 448/449 Ecology lecture/lab. Overview of biological and physical processes in ecology via combined lecture, research, field experimentation, and data analysis;(One of BIO 270 or BIO 421/421 or BIO 474/475); BIO 270 Genetics. Lecture and mathematical/statistical analysis of molecular genetics, inheritance, and population study; BIO421/422 Microbiology lecture/lab. Biological survey of microbes employing demonstration and specialized techniques specific to the field.</p> <p>BIO 474/475 Cell & Molecular Biology lecture/lab. Basic concepts and experimentation using principles of biochemistry and cytochemistry in cellular function and interaction.*</p> <p><i>*When these Biology classes are listed for Standards 3 through 11, these explanations are to be applied. Thank you.</i></p> <p>As explained in Standards A and B, the students use the <i>MCF</i> regularly in their Education courses, especially in writing lesson and unit plans and preparing their personal "Science/Management Kit" folders in their science methods course, EDU 475.</p>	<p>BIO 120/121, BIO 122/123, BIO 451/452, BIO 499 Interactive seminar course directed by faculty and enacted by students via professional presentation and publication formats.*</p> <p><i>*When these Biology classes are listed for Standards 3 through 11, these explanations are to be applied. Thank you.</i></p> <p>BIO 260/261 or BIO 463/464</p> <p>BIO 420 OR BIO 270 OR BIO 375, AND BIO 448/449 OR BIO 421/422 OR BIO 474/475.</p> <p>TOTAL 34 including 6 credits of lab</p> <p>Electives: Described below.</p> <p>BIO 284/285 Animal Behavior w/ lab; BIO 350/351 Histology w/ lab; BIO 365 Human Anatomy; BIO 370/371 Embryology w/ lab; BIO 425 Immunology; BIO 441 Public Health Microbiology; BIO 498 Pathophysiology.</p> <p>As explained in Standards A and B, the students use the <i>MCF</i> regularly in their Education courses, especially in writing lesson and unit plans and preparing their personal "Science/Management Kit" folders in their science methods course, EDU 475.</p>

			Narrative Explaining How Required Course and/or Experiences Fulfill the Standards for Program	
No.	Standard/Guideline	Level of Proficiency	Secondary Minor	Secondary Minor
2.0	construct new knowledge by using research, reading and discussion, and reflect in an informed way on the role of science in human affairs; and		<p>BIO 103 Environment Science lecture. Topic oriented course providing environmental information for making intelligent choices for scientific, social, political and economic issues.</p> <p>In EDU 440 School and Society and EDU 514 Society and Education, students reinforce their ability to construct new knowledge about Education and society through research strategies similar to those practiced in biological writing.</p>	<p>BIO 499 Biology and Social Issues. Senior Seminar, in which students learn to research biological literature, read and interpret original resources, and integrate the information into a review article. The second objective of the course is to understand the ways in which the discipline of biology has an impact on society and the ways in which society has an impact upon science.</p> <p>In EDU 440 School and Society and EDU 514 Society and Education, students reinforce their ability to construct new knowledge about Education and society through research strategies similar to those practiced in biological writing.</p>
3.0	understand and develop the major concepts and principles of biology, including concepts in:			
3.1	Cellular Function, including			
3.1.1	cell theory	B	BIO 120/ 121 General Biology I lecture/lab, foundational course w/ research-based lab experiences; BIO 451 Plant Form & Function; BIO 448/449 Ecology w/ lab, research-based lab experiences; BIO 474 Cell & Molecular Biology, experimental methodology course.	BIO 120/ 121 General Biology I lecture/lab, foundational course w/ research-based lab experiences; BIO 451 Plant Form & Function; BIO 448/449 Ecology w/ lab, research-based lab experiences; BIO 474 Cell & Molecular Biology, experimental methodology course.

			Narrative Explaining How Required Course and/or Experiences Fulfill the Standards for Program	
No.	Standard/Guideline	Level of Proficiency	Secondary Minor	Secondary Minor
3.1.2	cell types	B	BIO 122/123 General Biology II w/ lab; BIO 474/475 Cell & Molecular Biology w/ lab.	BIO 108 Science of Life, utilizes various media that include Web-based applications; BIO 122/123 General Biology II w/ lab; BIO 350/351 Histology w/ lab, Visually presented course emphasizing structure/function correlations; BIO 474/475 Cell & Molecular Biology w/ lab; BIO 463/464 Physiology w/ lab emphasizes experimental design via system modeling.
3.1.3	cell structure and function	C	BIO 120 General Biology I; BIO 421 Microbiology; BIO 451 Plant Form & Function; BIO 474 Cell & molecular Biology.	BIO 108 Science of Life; BIO 120 General Biology I; BIO 421 Microbiology; BIO 451 Plant Form & Function; BIO 463/464 Physiology w/ lab; BIO 474 Cell & molecular Biology.
3.1.4	protein synthesis	C	BIO 120 General Biology I; BIO 474 Cell & Molecular Biology.	BIO 120 General Biology I; BIO 463 Physiology; BIO 474 Cell & Molecular Biology.
3.1.5	cell division (mitosis and meiosis)	C	BIO 121 General Biology Lab I; BIO 421 Microbiology.	BIO 108 Science of Life; BIO 121 General Biology Lab I; BIO 421 Microbiology.
3.2	Organization of Living Things, including			
3.2.1	life cycles (including sexual and asexual reproduction)	C	BIO 120/121 & 122/123 General Biology lecture w/ labs I & II, survey reproductive cycles among all representative living groups; BIO 421 Microbiology; BIO 451 Plant Form & Function.	BIO 120/121 & 122/123 General Biology lecture w/ labs I & II, survey reproductive cycles among all representative living groups; BIO 260/261 Comparative Anatomy, gross comparative level; BIO 350/351 Histology w/ lab, microscope level; BIO 421 Microbiology; BIO 451 Plant Form & Function.

			Narrative Explaining How Required Course and/or Experiences Fulfill the Standards for Program	
No.	Standard/Guideline	Level of Proficiency	Secondary Minor	Secondary Minor
3.2.2	Systems	C	BIO 122/123 General Biology II; BIO 451 Plant Form and Function.	BIO 122/123 General Biology II; BIO 260/261 Comparative Anatomy; BIO 451 Plant Form and Function.
3.2.3	classification	C	BIO 120/121 & 122/123 General Biology lecture w/ labs I & II; BIO 451 Plant Form & Function.	BIO 120/121 & 122/123 General Biology lecture w/ labs I & II; BIO 260/261 Comparative Anatomy w/ lab; BIO 451 Plant Form & Function.
3.2.4	growth and development	B	BIO 120 & 122 General Biology lectures I & II, foundational survey; BIO 451 Plant Form & Function.	BIO 120 & 122 General Biology lectures I & II, foundational survey; BIO 260/261 Comparative Anatomy w/ lab, evolutionary & gross level; BIO 370/371 Embryology w/ lab, animal-focus w/ practical application & modeling; BIO 451 Plant Form & Function.
3.2.5	photosynthesis	C	BIO 120 General Biology I lecture; BIO 451 Plant Form & Function; BIO 448/449 Ecology; BIO 451 Plant Form & Function; BIO 474 Cell & Molecular Biology, molecular level involving model systems.	BIO 120 General Biology I lecture; BIO 451 Plant Form & Function; BIO 448/449 Ecology; BIO 451 Plant Form & Function; BIO 474 Cell & Molecular Biology, molecular level involving model systems.
3.2.6	cellular respiration	C	BIO 120 General Biology I; BIO 474 Cell & Molecular Biology.	BIO 108 Science of Life; BIO 120 General Biology I; BIO 474 Cell & Molecular Biology.
3.2.7	living and nonliving	C	BIO 120/121 & 122/123 General Biology lecture w/ labs I & II; BIO 448/449 Ecology w/ lab; BIO 474/475 Cell & Molecular Biology w/ lab.	BIO 120/121 & 122/123 General Biology lecture w/ labs I & II; BIO 290 Biometrics; BIO 448/449 Ecology w/ lab; BIO 474/475 Cell & Molecular Biology w/ lab.
3.3	Concepts of Heredity, including			

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No.	Standard/Guideline	Level of Proficiency	Secondary Minor	Secondary Minor
3.3.1	Mendelian genetics	C	BIO 120/121 General Biology I; BIO 474 Cell & Molecular Biology.	BIO 108 Science of Life; BIO 120/121 General Biology I; BIO 270 Genetics; BIO 474 Cell & Molecular Biology.
3.3.2	molecular genetics (structure of DNA)	C	BIO 120 General Biology I; BIO 421/422 Microbiology; BIO 474/475 Cell & Molecular Biology.	BIO 108 Science of Life; BIO 120 General Biology I; BIO 270 Genetics; BIO 421/422 Microbiology; BIO 463 Physiology; BIO 474/475 Cell & Molecular Biology.
3.3.3	modern genetics (electrophoresis, genetic engineering, DNA fingerprinting, etc.)	C	BIO 120 General Biology I; BIO 421/422 Microbiology; BIO 474 Cell & Molecular Biology.	BIO 120 General Biology I; BIO 270 Genetics; BIO 421/422 Microbiology; BIO 474 Cell & Molecular Biology.
3.3.4	population genetics	B	BIO 120 & 122 General Biology I & II; BIO 474/475 Cell & Molecular Biology w/ lab.	BIO 120 & 122 General Biology I & II; BIO 420 Evolution; BIO 474/475 Cell & Molecular Biology w/ lab.
3.4	Evolutionary Changes, including			
3.4.1	diversity/speciation	B	BIO 121 General Biology I lab; BIO 122 General Biology II; BIO 448/449 Ecology w/ lab; BIO 452 Plant Form & Function lab.	BIO 108 Science of Life; BIO 121 General Biology I lab; BIO 122 General Biology II; BIO 260/261 Comparative Anatomy; BIO 420 Evolution; BIO 448/449 Ecology w/ lab; BIO 452 Plant Form & Function lab.
3.4.2	adaptation and natural selection	C	BIO 122 General Biology II; BIO 420 Evolution; BIO 448/449 Ecology w/ lab.	BIO 108 Science of Life; BIO 122 General Biology II; BIO 260/261 Comparative Anatomy; BIO 420 Evolution; BIO 448/449 Ecology w/ lab.

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No.	Standard/Guideline	Level of Proficiency	Secondary Minor	Secondary Minor
3.4.3	fossils/ancient life	A	BIO 121 General Biology lab I; BIO 122 General Biology lecture I; BIO 420 Evolution; BIO 452 Plant Form & Function lab.	BIO 108 Science of Life; BIO 121 General Biology lab I; BIO 122 General Biology lecture I; BIO 260/261 Comparative Anatomy; BIO 420 Evolution; BIO 452 Plant Form & Function lab.
3.4.4	extinction	B	BIO 122 General Biology lecture II; BIO 420 Evolution.	BIO 108 Science of Life; BIO 122 General Biology lecture II; BIO 260/261 Comparative Anatomy; BIO 420 Evolution.
3.5	Ecological Systems, including			
3.5.1	community relationships, including predator/prey and symbiosis	C	BIO 421 Microbiology; BIO 448/449 Ecology w/ lab.	BIO 108 Science of Life; BIO 421 Microbiology; BIO 448/449 Ecology w/ lab.
3.5.2	population	B	BIO 448/449 Ecology w/ lab.	BIO 108 Science of Life; BIO 448/449 Ecology w/ lab.
3.5.3	transfer of energy (food chains/webs)	C	BIO 120 General Biology I w/ lab.	BIO 120 General Biology I w/ lab; BIO 108 Science of Life.
3.5.4	biogeochemical cycles	C	BIO 421 Microbiology; BIO 448/449 Ecology w/ lab.	BIO 108 Science of Life; BIO 421 Microbiology; BIO 448/449 Ecology w/ lab.
3.5.5	human impact	C	BIO 448/449 Ecology w/ lab.	BIO 448/449 Ecology w/ lab.
3.6	Human Biology, including			

			Narrative Explaining How Required Course and/or Experiences Fulfill the Standards for Program	
No.	Standard/Guideline	Level of Proficiency	Secondary Minor	Secondary Minor
3.6.1	anatomy and physiology	C	BIO 122/123 General Biology II w/ lab; BIO 421/422 Microbiology w/ lab.	BIO 122/123 General Biology II w/ lab; BIO 350/351 Histology w/ lab; BIO 365 Human Anatomy; BIO 425 Immunology; BIO 421/422 Microbiology w/ lab; BIO 441 Public Health Microbiology; BIO 463/464 Physiology.
3.6.2	disease and immunology	B	BIO 122/123 General Biology II w/ lab.	BIO 108 Science of Life; BIO 122/123 General Biology II w/ lab; BIO 425 Immunology; BIO 441 Public Health Microbiology; BIO 463 Physiology; BIO 498 Pathophysiology.
3.6.3	health habits	B	BIO 463 Physiology.	BIO 108 Science of Life; BIO 463 Physiology.
3.6.4	resource management	B	BIO 103 Environmental Science.	BIO 499 Biology and Social Issues.
3.6.5	human population growth and diversity	B	BIO 103 Environmental Science; BIO 122 General Biology II lecture.	BIO 122 General Biology II lecture; BIO 499 Biology and Social Issues.

		Narrative Explaining how Required Courses and/or Experiences Fulfill the Standards for Program	
No.	Standard/Guideline	Secondary Minor	Secondary Major
	The preparation of high school biology teachers will enable them to:		
4.0	develop an understanding and appreciation for the nature of scientific inquiry;	<p>BIO 103 Environmental Science; BIO 120 & 122 General Biology I; BIO 448/449 Ecology w/ lab; BIO 451 Plant Form and Function.</p> <p>The classroom activities and laboratory experiences in these Biology courses are designed to promote inquiry-based investigations.</p> <p>The assignments, projects, presentations, discussions, and other instructional practices in the Education courses continue the candidates' involvement in scientific inquiry. They graduate understanding that decision-making throughout the field of education must be data driven.</p>	<p>BIO 108 Science of Life ; BIO 120 & 122 General Biology I; BIO 290 Biometrics; BIO 371 Embryology lab; BIO 448/449 Ecology w/ lab; BIO 451 Plant Form and Function; BIO 464 Physiology lab.</p> <p>The classroom activities and laboratory experiences in these Biology courses are designed to promote inquiry-based investigations.</p> <p>The assignments, projects, presentations, discussions, and other instructional practices in the Education courses continue the candidates' involvement in scientific inquiry. They graduate understanding that decision-making throughout the field of education must be data driven.</p>

		Narrative Explaining how Required Courses and/or Experiences Fulfill the Standards for Program	
No.	Standard/Guideline	Secondary Minor	Secondary Major
5.0	relate the concepts of biology to contemporary, historical, technological and societal issues; in particular, relate concepts of biology to current controversies, such as those around cloning, medical research, and genetically-modified food, as well as other issues;	<p>BIO 103 Environmental Science; BIO 121 General Biology I lab; BIO 448/449 Ecology w/ lab; BIO 451 Plant Form and Function.</p> <p>The relationship of biological concepts to societal issues, especially in regard to health related issues, is learned through reading text and selected articles, lectures and discussions, in class exercises, computer and WEB based projects, a short paper, and quizzes and examinations in BIO 103 Environmental Science. CHM 108 General Chemistry, one of the required supportive classes, enhances students' understanding. In BIO 122 General Biology II and its laboratory class (BIO 123), students reach an understanding of humans' place in the ecosystem.</p> <p>As the discovery of new biological concepts reaches the public (e.g. pharmaceutical) and implementation (e.g. animal cloning, bio-chemical attacks) occurs, they impact society, the schools, and what is taught to elementary and secondary students. Through the interactive lecture and discussion format of EDU 440 School and Society and EDU 514 Society and Education, study of the impact of such issues on school finance and curriculum will facilitate the candidates' understanding of the connection of biological and bio-chemistry concepts to current and other issues.</p>	<p>BIO 121 General Biology I lab; BIO 290 Biometrics; BIO 448/449 Ecology w/ lab; BIO 451 Plant Form and Function; BIO 499 Biology and Social Issues.</p> <p>In BIO 122 General Biology II and its laboratory class (BIO 123), students reach an understanding of human's place in the ecosystem. CHM 108 General Chemistry, one of the required supportive classes, enhances students' understanding. In BIO 499, students learn to research biological literature and how to use it to review a biological related article. They also consider the ways in which society has an impact upon science and articulate their own value systems with regard to scientific issues while considering other views.</p> <p>As the discovery of new biological concepts reaches the public (e.g. pharmaceutical) and implementation (e.g. animal cloning, bio-chemical attacks) occurs, they impact society, the schools, and what is taught to elementary and secondary students. Through the interactive lecture and discussion format of EDU 440 School and Society and EDU 514 Society and Education, study of the impact of such issues on school finance and curriculum will facilitate the candidates' understanding of the connection of biological and bio-chemistry concepts to current and other issues.</p>

		Narrative Explaining how Required Courses and/or Experiences Fulfill the Standards for Program	
No.	Standard/Guideline	Secondary Minor	Secondary Major
6.0	apply mathematics, including statistics, to investigations in biology/life sciences and the analysis of data;	<p>BIO 121 General Biology I lab; BIO 421/422 Microbiology w/ lab; BIO 448/449 Ecology w/ lab.</p> <p>Use of quantitative mathematical analysis occurs in the listed classes (homework assignments, in-class experiments and exercises, projects, papers, exams) with a variety of biology/life topics.</p> <p>Education courses continue the candidates' development of their ability to analyze data to inform their teaching practices. In EDU 475 Curriculum and Methods of Teaching in Secondary Schools II: Science, their projects and papers must include demonstration of their use of data for teaching and assessing their secondary students.</p>	<p>BIO 121 General Biology I lab; BIO 290 Biometrics; BIO 421/422 Microbiology w/ lab; BIO 448/449 Ecology w/ lab; BIO 464 Physiology lab.</p> <p>Use of quantitative mathematical analysis occurs in the listed classes (homework assignments, in-class experiments and exercises, projects, papers, exams) with a variety of biology/life topics.</p> <p>Education courses continue the candidates' development of their ability to analyze data to inform their teaching practices. In EDU 475 Curriculum and Methods of Teaching in Secondary Schools II: Science, their projects and papers must include demonstration of their use of data for teaching and assessing their secondary students.</p>

		Narrative Explaining how Required Courses and/or Experiences Fulfill the Standards for Program	
No.	Standard/Guideline	Secondary Minor	Secondary Major
7.0	understand and promote the maintenance of a safe science classroom as identified by the Council of State Science Supervisors, and including the ethical and appropriate use and care for living organisms and scientific equipment, and the safe storage, use, and disposal of chemicals;	<p>BIO 121 General Biology I lab; BIO 448/449 Ecology w/ lab.</p> <p>Discussed and practiced in all laboratory classes.</p> <p>Teacher Education candidates will see the qualities of a safe classroom during the field study/case study project in EDU 401/402 when they spend time in a 9-12 grade classroom of their major and/or minor. EDU 469, which includes study of classroom leadership/management, will enhance the candidates' ability to provide safe classrooms. The unique requirements for safety in a Biology classroom and laboratory are studied and demonstrated in the science methods course, EDU 475. During their Student Teaching experience, candidates are expected to follow and enforce the policies of the school to which they are assigned.</p>	<p>BIO 121 General Biology I lab; BIO 260/261 Comparative Anatomy w/ lab; BIO 448/449 Ecology w/ lab; BIO 464 Physiology lab.</p> <p>Discussed and practiced in all laboratory classes.</p> <p>Teacher Education candidates will see the qualities of a safe classroom during the field study/case study project in EDU 401/402 when they spend time in a 9-12 grade classroom of their major and/or minor. EDU 469, which includes study of classroom leadership/management, will enhance the candidates' ability to provide safe classrooms. The unique requirements for safety in a Biology classroom and laboratory are studied and demonstrated in the science methods course, EDU 475. During their Student Teaching experience, candidates are expected to follow and enforce the policies of the school to which they are assigned.</p>

		Narrative Explaining how Required Courses and/or Experiences Fulfill the Standards for Program	
No.	Standard/Guideline	Secondary Minor	Secondary Major
8.0	locate resources, design and conduct inquiry-based open-ended investigations in biology, interpret findings, communicate results, and make judgments based on evidence;	<p>BIO 121 General Biology I lab; BIO 448/449 Ecology w/ lab.</p> <p>In BIO 121, students are required to write their experiments on the exercise sheets in their manuals. The experiment on cold acclimation must be written as a formal lab report according to a rubric. In BIO 448/449, students study concepts in the discipline of ecology, design an ecological study using scientific methods, do a scientific literature search, perform appropriate statistical analysis of data, and write scientific research papers.</p> <p>In order for Teacher Education candidates to teach these skills to their secondary students, they must attain the research skills unique to biology in the Biology classes. The Education courses require students to use basic research skills to investigate educational issues and to create curriculum, units, and lessons for their potential secondary students (EDU 401/402, 469, 475) and to demonstrate their ability to teach the skills during their Student Teaching semester. The Education Department’s “Conceptual Framework” clearly states that all graduates will be life long learners and professional educators who are scholars, inquirers, and ethical professionals.</p>	<p>BIO 121 General Biology I lab; BIO 448/449 Ecology w/ lab; BIO 464 Physiology lab; BIO 490 Directed Studies, Library Research; BIO 492 Directed Studies, Laboratory Research.</p> <p>In BIO 121, students are required to write their experiments on the exercise sheets in their manuals. The experiment on cold acclimation must be written as a formal lab report according to a rubric. In BIO 448/449, students study concepts in the discipline of ecology, design an ecological study using scientific methods, do a scientific literature search, perform appropriate statistical analysis of data, and write scientific research papers. In 464 the students perform experiments and present 9 lab reports for evaluation. While BIO 490 and 492 are not required for Biology Majors seeking Teacher Education Certification, students who take these courses develop their ability to make judgments based on evidence even more deeply.</p> <p>In order for Teacher Education candidates to teach these skills to their secondary students, they must attain the research skills unique to biology in the Biology classes. The Education courses require students to use basic research skills to investigate educational issues and to create curriculum, units, and lessons for their potential secondary students (EDU 401/402, 469, 475) and to demonstrate their ability to teach the skills during their Student Teaching semester. The Education Department’s “Conceptual Framework” clearly states that all graduates will be life long learners and professional educators who are scholars, inquirers, and ethical professionals.</p>

		Narrative Explaining how Required Courses and/or Experiences Fulfill the Standards for Program	
No.	Standard/Guideline	Secondary Minor	Secondary Major
9.0	demonstrate competence in the practice of teaching through investigative experiences by demonstrating the application of the scientific processes, and in assessing student learning through multiple processes;	<p>BIO 121 General Biology I lab; BIO 448/449 Ecology w/ lab; BIO 451 Plant Form and Function.</p> <p>The mixture of lecture, lab, small group learning, problem solving, library research, and student presentations in the Biology courses demonstrates these principles.</p> <p>The mission of the UDM Teacher Education Program emphasizes the conceptualization of the role of the teacher as having three dimensions: developing teachers who behave professionally as scholars, inquirers, and moral agents. The Education courses seek to prepare students who are skilled in decision-making and in ethical, critical, and reflective thinking (inquirers) and who use the research-knowledge base for teaching, integrated with the liberal arts and sciences disciplines (scholars). As explained in Standards A, B, 7.0 and 8.0 of this matrix plus in Part C Varied Instructional Approaches of Section 2, the major assignment of EDU 401/402 is an investigative experience requiring the application of scientific processes. They conduct a field/case study that relies on observation, analysis, and written explanations and conclusions. While the research required in courses such as EDU 420 or 525 (Philosophy and Policy Studies) and in EDU or 514 (Schools/Education and Society) does not result in physical science findings that research in Biology demands, similar processes and methods are adhered to as candidates study and report their findings about aspects of education practice. In the methods courses (EDU 469, 475), candidates learn how to apply the appropriate investigative practices to assessing their students' learning and reporting their findings to parents and school officials. In EDU 475, students demonstrate to the class one lesson which includes assessment. The class discusses the entire lesson and how student performance is evaluated. Multiple intelligence and processes articles are distributed and discussed in class.</p>	<p>BIO 121 General Biology I lab; BIO 448/449 Ecology w/ lab; BIO 451 Plant Form and Function; BIO 464 Physiology lab.</p> <p>The mixture of lecture, lab, small group learning, problem solving, library research, and student presentations in the Biology courses demonstrates these principles.</p> <p>The mission of the UDM Teacher Education Program emphasizes the conceptualization of the role of the teacher as having three dimensions: developing teachers who behave professionally as scholars, inquirers, and moral agents. The Education courses seek to prepare students who are skilled in decision-making and in ethical, critical, and reflective thinking (inquirers) and who use the research-knowledge base for teaching, integrated with the liberal arts and sciences disciplines (scholars). As explained in Standards A, B, 7.0 and 8.0 of this matrix plus in Part C Varied Instructional Approaches of Section 2, the major assignment of EDU 401/402 is an investigative experience requiring the application of scientific processes. They conduct a field/case study that relies on observation, analysis, and written explanations and conclusions. While the research required in courses such as EDU 420 or 525 (Philosophy and Policy Studies) and in EDU or 514 (Schools/Education and Society) does not result in physical science findings that research in Biology demands, similar processes and methods are adhered to as candidates study and report their findings about aspects of education practice. In the methods courses (EDU 469, 475), candidates learn how to apply the appropriate investigative practices to assessing their</p>

		Narrative Explaining how Required Courses and/or Experiences Fulfill the Standards for Program	
No.	Standard/Guideline	Secondary Minor	Secondary Major
9.0(cont.)	demonstrate competence in the practice of teaching through investigative experiences by demonstrating the application of the scientific processes, and in assessing student learning through multiple processes;	<p>One of their “teaching/management kit” folders contains materials about how they will assess students. Handouts are given and explained on various types of assessment, which they are expected to apply in appropriate assignments. Examples of how to write rubrics are demonstrated and practiced, especially in terms of the MEAP tests. Students also learn how to write mid-term and final examinations. Their field experience for EDU 475 includes the candidates teaching two lessons which demonstrate the application of scientific processes. The education technology courses (EDU 459 and 460) place emphasis on authentic assessment using various processes. During the candidates’ student teaching experience (EDU 490, 474, or 484), they are required to apply these principles and processes to their involvement in assessing secondary students’ progress according to the high school’s policies.</p>	<p>students’ learning and reporting their findings to parents and school officials. In EDU 475, students demonstrate to the class one lesson which includes assessment. The class discusses the entire lesson and how student performance is evaluated. Multiple intelligence and processes articles are distributed and discussed in class. One of their “teaching/management kit” folders contains materials about how they will assess students. Handouts are given and explained on various types of assessment, which they are expected to apply in appropriate assignments. Examples of how to write rubrics are demonstrated and practiced, especially in terms of the MEAP tests. Students also learn how to write mid-term and final examinations. Their field experience for EDU 475 includes the candidates teaching two lessons which demonstrate the application of scientific processes. The education technology courses (EDU 459 and 460) place emphasis on authentic assessment using various processes. During the candidates’ student teaching experience (EDU 490, 474, or 484), they are required to apply these principles and processes to their involvement in assessing secondary students’ progress according to the high school’s policies.</p>

		Narrative Explaining how Required Courses and/or Experiences Fulfill the Standards for Program	
No.	Standard/Guideline	Secondary Minor	Secondary Major
10.0	create and maintain an educational environment in which conceptual understanding will occur for all science students; and	<p>BIO 121 General Biology I lab; BIO 448/449 Ecology w/ lab; BIO 451 Plant Form and Function. Small group learning and collaboration are components of most Biology classes, including 100-level classes.</p> <p>Once again, students learn how to create and maintain a positive classroom environment for conceptual understanding of Biology principles and skills in EDU 401/402 and in the methods courses: EDU 469 and 475. In the education technology courses (EDU 459 and 600), project based learning based on research with emphasis on constructivism and scaffolding is required; thereby providing the candidates with strategies to create and maintain a positive learning environment for all students. SED 460 Education and Mainstreaming of Exceptional Persons is required for all Education candidates. The principles of mainstreaming and the instructional methodologies and approaches to meet the needs of the various exceptionalities within the “least restrictive environment” and/or general classroom setting are examined and explored. Objective 9 identifies that candidates will demonstrate the ability to present concepts and manage special education students at different levels and within the regular classroom. In their student teaching assignments (EDU 490, 474, 484), part of the candidates’ assessments is their ability to provide such a learning environment for their secondary students.</p>	<p>BIO 121 General Biology I lab; BIO 290 Biometrics; BIO 448/449 Ecology w/ lab; BIO 451 Plant Form and Function; BIO 464 Physiology lab. Small group learning and collaboration are components of most Biology classes, including 100-level classes.</p> <p>Once again, students learn how to create and maintain a positive classroom environment for conceptual understanding of Biology principles and skills in EDU 401/402 and in the methods courses: EDU 469 and 475. In the education technology courses (EDU 459 and 600), project based learning based on research with emphasis on constructivism and scaffolding is required; thereby providing the candidates with strategies to create and maintain a positive learning environment for all students. SED 460 Education and Mainstreaming of Exceptional Persons is required for all Education candidates. The principles of mainstreaming and the instructional methodologies and approaches to meet the needs of the various exceptionalities within the “least restrictive environment” and/or general classroom setting are examined and explored. Objective 9 identifies that candidates will demonstrate the ability to present concepts and manage special education students at different levels and within the regular classroom. In their student teaching assignments (EDU 490, 474, 484), part of the candidates’ assessments is their ability to provide such a learning environment for their secondary students.</p>

		Narrative Explaining how Required Courses and/or Experiences Fulfill the Standards for Program	
No.	Standard/Guideline	Secondary Minor	Secondary Major
11.0	demonstrate competence in the practice of teaching as defined within the Entry-Level Standards for Michigan Teachers, as observed during the directed teaching experience.	<p>Successful completion of courses demonstrating competence in the subject qualifies students as potential teaching assistants for subsequent courses within the Biology department. Classes above the 100-level routinely involve student presentations to peers and faculty members.</p> <p>The Education program is built around the <i>Entry-Level Standards for Michigan Teachers (ELSMT)</i>. Assignments are required to reference the <i>ELSMT</i>. The portfolio that UDM students prepare throughout their Education program is designed to demonstrate their acquisition of the Entry-Level standards. For example in EDU 469, students create a variety of “Portfolio Quality Assignments” that must reference the MDE web sites and demonstrate use of the materials and standards offered. In EDU 459 and 600 (Education Technology), the objectives are set using ELSMT standards. In addition to related lectures and discussions, the students are expected to use and reference these standards in their assignments, written and class presentations. In EDU 475 Science Methods, the students begin their personal collection of folders for their “teaching management kit.” Students are required to use the MDE sites as basis for their field experience and observation write ups and for their lesson/unit plans that are part of the course. Lectures and classroom discussions help students understand the ELSMT standards and how to incorporate them into their assignments.</p>	<p>Successful completion of courses demonstrating competence in the subject qualifies students as potential teaching assistants for subsequent courses within the Biology department. Classes above the 100-level routinely involve student presentations to peers and faculty members.</p> <p>The Education program is built around the <i>Entry-Level Standards for Michigan Teachers (ELSMT)</i>. Assignments are required to reference the <i>ELSMT</i>. The portfolio that UDM students prepare throughout their Education program is designed to demonstrate their acquisition of the Entry-Level standards. For example in EDU 469, students create a variety of “Portfolio Quality Assignments” that must reference the MDE web sites and demonstrate use of the materials and standards offered. In EDU 459 and 600 (Education Technology), the objectives are set using ELSMT standards. In addition to related lectures and discussions, the students are expected to use and reference these standards in their assignments, written and class presentations. In EDU 475 Science Methods, the students begin their personal collection of folders for their “teaching management kit.” Students are required to use the MDE sites as basis for their field experience and observation write ups and for their lesson/unit plans that are part of the course. Lectures and classroom discussions help students understand the ELSMT standards and how to incorporate them into their assignments.</p>

