

Preparing Competent, Committed, Professional Teachers for a Diverse, Democratic Society

Ohio Wesleyan University

Teacher Education: Sciences

Adolescent to Young Adult (AYA) Science Licensure Programs

Contextual Information:

Ohio Wesleyan University has been educating teachers for over one hundred years. Ohio Wesleyan offers programs for preparing preservice teachers for licensure at the Early Childhood (PK-3), Middle Childhood (Grades 4-9), Adolescent-to-Young Adult (Grades 7-12), and Multi-age (PK-12) levels. The Teacher Education Unit complements the liberal arts mission of the university by developing in its candidates the intellectual, personal, and professional competencies, skills, and dispositions necessary to teach students at each licensure level. The mission of the Adolescent-to-Young Adult (AYA) Science Licensure Programs at Ohio Wesleyan University (OWU) is to *prepare competent, committed, professional teachers for a diverse, democratic society*, teachers who can facilitate science learning of the highest quality for all adolescents.

Unique State Requirements:

- Ohio's Licensure Rule 3301-24-05 (C) (3)

Adolescence to Young Adult License, valid for teaching in grades seven through twelve in the curriculum areas named in such license. Preparation in the teaching field shall constitute at least an academic major or its equivalent with sufficient advanced coursework in all areas to be taught as specified by the teacher preparation institution and approved by the Ohio Department of Education. A minimum of three semester hours in the teaching of reading in the content area shall be required for the provisional or professional adolescence to young adult license.

- Alignment with Ohio Academic Content Standards: All course content must be aligned with the Ohio K-12 Academic Content Standards. Alignments with the Science Standards have been approved by the State.

Unique Institutional Curricular Policies:

Candidates in the Adolescent-to-Young Adult (AYA) Science Licensure Programs at Ohio Wesleyan University must complete a major in their science content area and a minor in education. The science major consists of a minimum of ten courses (37.50 semester hours) of science content. The education minor consists of two-unit foundation courses (7.5 semester hours), a unit course (3.75 semester hours) in general methods, which focuses on the development of the preservice teachers' understanding of high school students as well as the curriculum, instructional and assessment strategies, and the integration of instructional technology at the high school level., and a half-unit course (1.875 semester hours) of science methods, which focuses specifically on best practices for teaching science to adolescents. During the three-unit student teaching experience, all candidates also complete a half-unit course (1.875 semester hours) that focuses on content-area reading and writing strategies as well as applied technology strategies. Thus, the education minor for the AYA Science Licensure Programs consists of six-unit courses and four-half unit courses for a total of 8 units (30 semester hours). In addition, one diversity course is required as an Ohio Wesleyan University competency requirement for graduation; however, all candidates seeking licensure at OWU are required to take a second diversity course.

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Program	Number of Candidates		
	2011-2012	2010-2011	2009-2010
Sciences	# Enrollment = 3 (2 Life Sciences; 1 Chemistry) # Anticipated Completers = 2 Life Sciences	# Enrolled = 2 # Completers= 0	# Enrolled = 0 # Completers= 0

Challenges for the AYA Science Licensure Programs:

As evidenced by the chart above the Adolescent-to-Young Adult (AYA) Science Education Licensure Programs at OWU is experiencing a decline in enrollment. Teacher Education Unit will be working with OWU Science Department, Admissions, and the local high schools to deliberately recruit more individuals who are interested in becoming science teachers. In addition, the Teacher Education Unit will seek a Science Educator who can teach the Science Content: Methods (EDUC 367) on a more regular basis.

SECTION II – List of Assessments

Name of Assessment¹		Type or Form of Assessment²	When the Assessment Is Administered³
1	[Assessment #1: Content Knowledge – Licensure Tests] Praxis II Content Exam: Chemistry (0245); Earth Sciences (0571); Life Sciences (0235); Physics (0265)	State Mandated Licensure Exam	During senior year – required for Gateway 4: Recommendation for Licensure
2	[Assessment #2: Content Knowledge – an assessment of general content knowledge in discipline to be taught] Content Area Licensure GPA	Science Licensure GPA – in science content courses	Calculated at end of senior year
3	[Assessment #3: Pedagogical and Professional Knowledge, Skills and Dispositions – Planning instruction and assessment] A-M-T Learning Task	Acquisition-Meaning-Transfer (A-M-T) Task (New task)	Required course – senior year [EDUC 367 – Secondary Methods: Science]
4	[Pedagogical and Professional Knowledge, Skills and Dispositions – Student Teaching Assessment] OWU Student Teaching Evaluation with NSTA Addendum	Student Teaching Assessment Instrument With NSTA addendum	Gateway 3 – End of Student Teaching
5	[Assessment #5: Effects on Student Learning] Teaching Unit Science	Instructional Unit (To be replaced with the Teacher Performance Assessment in Science effective 2012-1013)	During Student Teaching [EDUC 471-473 – Secondary Student Teaching]
6	[Assessment #6: Pedagogical and Professional Knowledge, Skills and Dispositions – Legal/Safety/Ethical Issues (required)]	Test – multiple choice, short-answer, extended response	Required course – Fall semester either junior or senior year [EDUC 367 – Secondary Methods: Science]

¹ Identify assessment by title used in the program; refer to Section IV for further information on appropriate assessment to include.

² Identify the type of assessment (e.g., essay, case study, project, comprehensive exam, reflection, state licensure test, portfolio).

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	Science Safety Test		
7	Assessment#7: Content Knowledge – Research & Investigation (required) Assessment] Research in Science Project	Research Project (New task)	Required course – Fall semester either junior or senior year [EDUC 367 – Secondary Methods: Science]
8	Assessment #8: Content Knowledge – Contextual Content (required)] Content Analysis Paper	Written Paper (New task)	Required course – Fall semester either junior or senior year [EDUC 367 – Secondary Methods: Science]

NSTA STANDARD	APPLICABLE ASSESSMENTS FROM SECTION II
<p>1. Content. Teachers of science understand and can articulate the knowledge and practices of contemporary science. They can interrelate and interpret important concepts, ideas, and applications in their fields of licensure; and can conduct scientific investigations. To show that they are prepared in content, teachers of science must demonstrate that they (a) understand and can successfully convey to students the major concepts, principles, theories, laws, and interrelationships of their fields of licensure and supporting fields as recommended by the National Science Teachers Association; (b) understand and can successfully convey to students the unifying concepts of science delineated by the National Science Education Standards; (c) understand and can successfully convey to students important personal and technological applications of science in their fields of licensure; (d) understand research and can successfully design, conduct, report and (e) evaluate investigations in science; and understand and can successfully use mathematics to process and report data, and solve problems, in their field(s) of licensure.</p>	<input checked="" type="checkbox"/> #1 <input checked="" type="checkbox"/> #2 <input checked="" type="checkbox"/> #3 <input type="checkbox"/> #4 <input checked="" type="checkbox"/> #5 <input type="checkbox"/> #6 <input checked="" type="checkbox"/> #7 <input checked="" type="checkbox"/> #8
<p>2. Nature of Science. Teachers of science engage students effectively in studies of the history, philosophy, and practice of science. They enable students to distinguish science from nonscience, understand the evolution and practice of science as a human endeavor, and critically analyze assertions made in the name of science. To show they are prepared to teach the nature of science, teachers of science must demonstrate that they (a) understand the historical and cultural development of science and the evolution of knowledge in their discipline; (b) understand the philosophical tenets, assumptions, goals, and values that distinguish science from technology and from other ways of knowing the world; and (c)</p>	<input type="checkbox"/> #1 <input type="checkbox"/> #2 <input checked="" type="checkbox"/> #3 <input type="checkbox"/> #4 <input checked="" type="checkbox"/> #5 <input type="checkbox"/> #6 <input type="checkbox"/> #7 <input checked="" type="checkbox"/> #8

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NSTA STANDARD	APPLICABLE ASSESSMENTS FROM SECTION II
engage students successfully in studies of the nature of science including, when possible, the critical analysis of false or doubtful assertions made in the name of science.	
<p>3. Inquiry. Teachers of science engage students both in studies of various methods of scientific inquiry and in active learning through scientific inquiry. They encourage students, individually and collaboratively, to observe, ask questions, design inquiries, and collect and interpret data in order to develop concepts and relationships from empirical experiences. To show that they are prepared to teach through inquiry, teachers of science must demonstrate that they (a) understand the processes, tenets, and assumptions of multiple methods of inquiry leading to scientific knowledge; and (b) engage students successfully in developmentally appropriate inquiries that require them to develop concepts and relationships from their observations, data, and inferences in a scientific manner.</p>	<input type="checkbox"/> #1 <input type="checkbox"/> #2 <input checked="" type="checkbox"/> #3 <input type="checkbox"/> #4 <input checked="" type="checkbox"/> #5 <input type="checkbox"/> #6 <input type="checkbox"/> #7 <input checked="" type="checkbox"/> #8
<p>4. Issues. Teachers of science recognize that informed citizens must be prepared to make decisions and take action on contemporary science- and technology-related issues of interest to the general society. They require students to conduct inquiries into the factual basis of such issues and to assess possible actions and outcomes based upon their goals and values. To show that they are prepared to engage students in studies of issues related to science, teachers of science must demonstrate that they (a) understand socially important issues related to science and technology in their field of licensure, as well as processes used to analyze and make decisions on such issues; and (b) engage students successfully in the analysis of problems, including considerations of risks, costs, and benefits of alternative solutions; relating these to the knowledge, goals and values of the students.</p>	<input type="checkbox"/> #1 <input type="checkbox"/> #2 <input checked="" type="checkbox"/> #3 <input type="checkbox"/> #4 <input checked="" type="checkbox"/> #5 <input type="checkbox"/> #6 <input type="checkbox"/> #7 <input checked="" type="checkbox"/> #8
<p>5. General Skills of Teaching. Teachers of science create a community of diverse learners who construct meaning from their science experiences and possess a disposition for further exploration and learning. They use, and can justify, a variety of classroom arrangements, groupings, actions, strategies, and methodologies. To show that they are prepared to create a community of diverse learners, teachers of science must demonstrate that they (a) vary their teaching actions, strategies, and methods to promote the development of multiple student skills and levels of understanding; (b) successfully promote the learning of science by students with different abilities, needs, interests, and backgrounds; (c) successfully organize and engage students in collaborative learning using different student group learning strategies; (d) successfully use technological</p>	<input type="checkbox"/> #1 <input type="checkbox"/> #2 <input type="checkbox"/> #3 <input checked="" type="checkbox"/> #4 <input checked="" type="checkbox"/> #5 <input type="checkbox"/> #6 <input type="checkbox"/> #7 <input type="checkbox"/> #8

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<p>tools, including but not limited to computer technology, to access resources, collect and process data, and facilitate the learning of science; (e) understand and build effectively upon the prior beliefs, knowledge, experiences, and interests of students; and (f) create and maintain a psychologically and socially safe and supportive learning environment. (optional to address this standard in the NSTA report)</p>	
<p>6. Curriculum. Teachers of science plan and implement an active, coherent, and effective curriculum that is consistent with the goals and recommendations of the National Science Education Standards. They begin with the end in mind and effectively incorporate contemporary practices and resources into their planning and teaching. To show that they are prepared to plan and implement an effective science curriculum, teachers of science must demonstrate that they (a) understand the curricular recommendations of the National Science Education Standards, and can identify, access, and/or create resources and activities for science education that are consistent with the standards; and (b) plan and implement internally consistent units of study that address the diverse goals of the National Science Education Standards and the needs and abilities of students.</p>	<input type="checkbox"/> #1 <input type="checkbox"/> #2 <input checked="" type="checkbox"/> #3 <input checked="" type="checkbox"/> #4 <input type="checkbox"/> #5 <input type="checkbox"/> #6 <input type="checkbox"/> #7 <input type="checkbox"/> #8
<p>7. Science in the Community. Teachers of science relate their discipline to their local and regional communities, involving stakeholders and using the individual, institutional, and natural resources of the community in their teaching. They actively engage students in science-related studies or activities related to locally important issues. To show that they are prepared to relate science to the community, teachers of science must demonstrate that they (a) identify ways to relate science to the community, involve stakeholders, and use community resources to promote the learning of science; and (b) involve students successfully in activities that relate science to resources and stakeholders in the community or to the resolution of issues important to the community.</p>	<input type="checkbox"/> #1 <input type="checkbox"/> #2 <input checked="" type="checkbox"/> #3 <input type="checkbox"/> #4 <input type="checkbox"/> #5 <input type="checkbox"/> #6 <input type="checkbox"/> #7 <input type="checkbox"/> #8
<p>8. Assessment. Teachers of science construct and use effective assessment strategies to determine the backgrounds and achievements of learners and facilitate their intellectual, social, and personal development. They assess students fairly and equitably, and require that students engage in ongoing self-assessment. To show that they are prepared to use assessment effectively, teachers of science must demonstrate that they (a) use multiple assessment tools and strategies to achieve important goals for instruction that are aligned with methods of instruction and the needs of students; (b) use the results of multiple assessments to guide and modify instruction, the classroom</p>	<input type="checkbox"/> #1 <input checked="" type="checkbox"/> #2 <input type="checkbox"/> #3 <input checked="" type="checkbox"/> #4 <input type="checkbox"/> #5 <input type="checkbox"/> #6 <input type="checkbox"/> #7 <input type="checkbox"/> #8

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<p>environment, or the assessment process; and (c) use the results of assessments as vehicles for students to analyze their own learning, engaging students in reflective self-analysis of their own work.</p>	
<p>9. Safety and Welfare. Teachers of science organize safe and effective learning environments that promote the success of students and the welfare of all living things. They require and promote knowledge and respect for safety, and oversee the welfare of all living things used in the classroom or found in the field. To show that they are prepared, teachers of science must demonstrate that they (a) understand the legal and ethical responsibilities of science teachers for the welfare of their students, the proper treatment of animals, and the maintenance and disposal of materials; (b) know and practice safe and proper techniques for the preparation, storage, dispensing, supervision, and disposal of all materials used in science instruction;</p> <p>(c) know and follow emergency procedures, maintain safety equipment, and ensure safety procedures appropriate for the activities and the abilities of students; and (d) treat all living organisms used in the classroom or found in the field in a safe, humane, and ethical manner and respect legal restrictions on their collection, keeping, and use.</p>	<input type="checkbox"/> #1 <input type="checkbox"/> #2 <input type="checkbox"/> #3 <input checked="" type="checkbox"/> #4 <input type="checkbox"/> #5 <input checked="" type="checkbox"/> #6 <input type="checkbox"/> #7 <input type="checkbox"/> #8
<p>10. Professional Growth. Teachers of science strive continuously to grow and change, personally and professionally, to meet the diverse needs of their students, school, community, and profession. They have a desire and disposition for growth and betterment. To show their disposition for growth, teachers of science must demonstrate that they (a) engage actively and continuously in opportunities for professional learning and leadership that reach beyond minimum job requirements; (b) reflect constantly upon their teaching and identify ways and means through which they may grow professionally; (c) use information from students, supervisors, colleagues and others to improve their teaching and facilitate their professional growth; and (d) interact effectively with colleagues, parents, and students; mentor new colleagues; and foster positive relationships with the community.</p> <p>(optional to address this standard in the NSTA report)</p>	<input type="checkbox"/> #1 <input type="checkbox"/> #2 <input type="checkbox"/> #3 <input checked="" type="checkbox"/> #4 <input type="checkbox"/> #5 <input type="checkbox"/> #6 <input type="checkbox"/> #7 <input type="checkbox"/> #8

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Assessment #1 – State Mandated Licensure Exams

The Praxis II content knowledge tests (Earth Sciences 0571; Chemistry 0245; Physics 0265; and Life Sciences 0235) are aligned with National Science Teachers Association (NSTA) Standard 1a: Understanding major concepts, principles, theories, laws and interrelationships of fields of licensure and supporting fields as recommended by NSTA. According to NSTA guidelines, “Praxis II should be assumed to align with NSTA standards.”

No data for academic years 2009-2010; 2010-2011. At the time of this report, the two candidates in Life Sciences had not taken their Praxis II exams.

Assessment #2 – Content Knowledge: GPA in Sciences

The grade point average (GPA) was calculated by examining the candidates grades in each of these required licensure courses/content areas: BOMI/ZOOL 100.5; BOMI/ZOOL 120, CHEM 110; CHEM 111; Conservation, Ecology & Evolution Content Knowledge; Cellular and Molecular Content Knowledge; Organismal and Human Biology Content Knowledge.

Mean Overall GPA in Life Science Candidates in the Adolescent to Young Adult (AYA) Science Licensure Programs

Year	n	GPA* Grade Point Average Mean (range)	% of candidates meeting and maintaining the min GPA expectation (2.80)
2011-2012	2	3.03	100%

*OWU Grading Scale: A+ = 4.0, A = 3.67, A- = 3.33, B+ = 3.00, B = 2.67, B- = 2.33, C+ = 2.00, C = 1.67, C- = 1.33, D+ = 1.00, D = .67, F = 0.00

Courses	n	GPA* Grade Point Average Mean (range)
BOMI/ZOOL 100.5	2	3.00 (3.00)
BOMI/ZOOL 120	1*	3.00 (3.00) <small>*AP credit awarded</small>
CHEM 110	2	3.00 (3.33 – 2.67)
CHEM 111	2	2.50 (3.00 – 2.00)
Conservation, Ecology & Evolution Content Knowledge	2	3.08 (3.33 – 3.00)
Cellular and Molecular Content Knowledge	2	2.93 (3.67 – 2.00)
Organismal and Human Biology Content Knowledge	2	3.33 (3.67 – 3.00)

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See the NSTA Content Analysis Chart for the alignment of the OWU Science courses with the NSTA Science Standards.

Assessment #3 – Ability to Plan

Previously in EDUC 367 – *Secondary Methods: Science*, candidates were assessed on their ability to plan lessons which demonstrated their understanding of the continuity of content (prior, current, future learning).

When EDUC 367 is taught next, candidates will complete a new learning task entitled the **Acquisition-Meaning-Transfer (A-M-T) chart**. This new assessment will provide evidence of candidates' ability to plan lessons that develop their students' scientific understandings at the different levels of learning: acquisition (knowledge and skills); meaning or understanding; and transfer. This learning task will also assess the candidates' ability to align learning targets, assessments, and instruction.

Assessment #4 – NSTA Addendum to the OWU Student Teaching Evaluation Form

Ohio Wesleyan University: **NSTA Addendum to the Student Teaching Evaluation** will be completed during student teaching and at the conclusion of the student teaching experience by both the candidate and the primary university supervisor. These formative and summative evaluations are reviewed with the preservice science teachers at the midterm and at the conclusion of student teaching so they can reflect on their growth as future science teachers.

Assessment #5 – Impact on Students' Learning - Teaching Unit

Student teachers are required to develop and teach one unit during their student teaching experience. The Teaching Unit must contain pre-assessment(s), formative assessment(s), and summative assessment(s). In addition, the candidates must collect samples of their students work at high, medium, and low performance levels to support their judgments about the effectiveness of the unit.

NOTE: This assessment will be replaced with the Teacher Performance Assessment in Secondary Sciences in 2012-2013.

Assessment #6 – Legal/Safety/Ethical Issues

Candidates in EDUC 367: *Secondary Science Methods* take the **Science Safety Test** as a pre-assessment and then read and discuss a series of article related to areas where they need to increase their science safety knowledge. Candidates then retake the **Science Safety Test**. The data table below indicates the candidates' post-assessment grades. NSTA Standards addressed in this assessment are 9a, b, c, and d.

Science Safety Test

Semester EDUC 367	Average Final Grade	Final Grade Range
Fall 2010 (n=2)	B = 3.00	3.00 -3.00

Grading Scale: A = 72-65 points correct; B= 64-58 points correct; C=57-50 points correct; D = 49-43 points correct; F = less than 42 points correct

This assessment will be continued in future offerings of EDUC 367.

Assessment #7 – Research & Investigation -

This assessment covers NSTA Standards 1 d-e and demonstrates candidates' knowledge of research and investigation in science. Each candidate (or small group) chooses a topic of interest to research, collecting, analyzing and interpreting data.

New Task – no data

Assessment #8 – Content Knowledge: Contextual Content: Unifying Concepts in Science

This new assessment “Unifying Concepts in Science” Paper will be administered the next time that EDUC 367: *Secondary Science* taught. The goal of the paper is for candidates' to demonstrate their understanding of the central concepts and methods of inquiry that they teach. Candidates will list the unifying concepts of science (systems, order, organization, evidence, models, explanation, constancy, change, measurement, evolution, equilibrium, form and function). Next, the candidates explain in their own words how the concepts are relevant/applicable in their science discipline (biology, chemistry, physics). Lastly, candidates explain the connection between their discipline and the other science disciplines. It addresses NSTA Standard 1b: understands the unifying concepts of science; 2b: understands the philosophical tenets assumptions, goals and values that distinguish science from technology and from other ways of knowing the world; 3a: understands the processes, tenets and assumption of multiple methods of inquiry leading to science knowledge and 4a: understands socially important issues related to science and technology in their field of licensure.

New Task – no data