Syllabus for
BIO 429 - Secondary Science Methods I
1.0 Credit Hour
Fall 2014

The Mission of the College of Education is to provide the opportunity for individuals who hold Christian principles to participate in advanced study in preparation for the professional public and private responsibilities in the field of education throughout the world.

I. COURSE DESCRIPTION

This course is designed to prepare science education teacher candidates with ideas and practical knowledge for the classroom situation. It focuses on materials and methods of teaching biology at the secondary level but could also be used to prepare teacher candidates in the subjects of chemistry, physics and physical science.

Prospective secondary school science teachers are taught science in forty or more credit hours of biology, chemistry, physics, and other science courses but are expected to learn how to teach science in a total of thirteen semester hours of methodology and student teaching. This course is designed to provide effective utilization of these thirteen credit hours. The course consists of a series of experiences in teaching as a whole that will be practiced in the relative security of a simulated secondary classroom situation and will be based upon needs that will develop when prospective teachers encounter real classrooms and students.

Course Prerequisites:

1. Admission to Professional Education Program (PEP)
2. Junior Standing
3. Permission of the Instructor

II. COURSE GOALS

The purpose of this course is to enable the teacher candidate to:

A. prepare prospective science teachers in the techniques and skills necessary for effective science education in the secondary level.

B. help uphold the mission of the ORU College of Education.

C. comply with the requirements of the Oklahoma Commission on Teacher Preparation. The course goals for the Teacher Preparation Program meet the "competency-based" requirements established by the Oklahoma Commission on Teacher Preparation.

III. COURSE OBJECTIVES

A. Objectives (*Note: all Institutional Standards (IS) reflect those adopted for 2012-2013 by the ORU College of Education*)

As a result of successfully completing this course, the teacher candidate will be able to:

1. choose and behaviorally define educational objectives. (IS 4-6)
2. write functional plans for instruction on a daily, weekly, semester, and yearly basis as well as plan instruction by unit or topic. (IS 4-5)
3. recognize and utilize the inquiry method of instructing science students. (IS 7-8)
4. demonstrate either orally or in writing an understanding of science curricula in American secondary schools. (IS 7-8)

© Copyright Oral Roberts University 2012. All rights reserved.

5. show a functional grasp of the processes involved in the selection of course content. (IS 5, 7, and 13)
6. use instructional technology. (IS 5 and 14)
7. identify sources of instructional materials. (IS 5-6)
8. demonstrate the skills of determining the instructional materials required for a semester of instruction in a specified science course and procedures in ordering the same. (IS 5-6)
9. demonstrate the skill involved in understanding learning and learning styles via the use and recognition of various learning styles and learning needs of both the teacher and students. (IS 7-9 and 16-18)
10. demonstrate skills in utilizing various teaching strategies. (IS 12-13)
11. show a grasp of evaluation techniques in science including the ability to interpret data. (IS 14-15)
12. differentiate the creative ability of secondary school science students by use of verbal and motor performance objectives. (IS 5, 7, 12 and 13)

B. Objectives for Teacher candidates in Teacher Preparation Programs

The course objectives for the teacher preparation program meet the competency-based requirements established by the Oklahoma Commission on Teacher Preparation. This course meets the following Institutional Standards: IS #4, 5, 6, 7, 8, 9, 12, 13, 14, 15, 16, 17 and 18.

1. 2012-2013 ORU COE Institutional Standards
   - IS 4: The candidate makes educational decisions (i.e. plans instruction and/or administrative duties) based on the principles of the whole person lifestyle, including the spiritual, physical, intellectual, social, and emotional aspects.
   - IS 5: The candidate draws upon knowledge of content areas, cross-disciplinary skills, technological resources, learners, the community, multiple and varied clinical experiences and knowledge of subject matter, *Core Curriculum*, and pedagogy to plan instruction that supports every student in meeting rigorous learning goals.
   - IS 6: The candidate understands the central concepts, tools of inquiry, and structures of the discipline(s) he/she teaches and creates learning experiences that make these aspects of the discipline(s) accessible and meaningful for learners.
   - IS 7: The candidate demonstrates an understanding of effective verbal, nonverbal and technological skills through a variety of instructional strategies to encourage learners to develop deep understanding of content areas and their connections to authentic local and global issues.
   - IS 8: The candidate is a reflective, transformed educator who uses research, research findings, contextual information, and other evidence to adapt his/her practices to meet the needs of each learner.
   - IS 9: The candidate understands how students learn and designs and implements developmentally appropriate and challenging learning experiences that are supportive of personal and career development.
   - IS 12: The candidate understands how students learn and develop, recognizing that patterns of learning and development vary individually within and across the cognitive, linguistic, social, emotional, spiritual and physical areas.
   - IS 13: The candidate understands how to connect concepts and uses differing perspectives to engage learners in critical/creative thinking, collaborative

© Copyright Oral Roberts University 2012. All rights reserved.

problem solving, and applying performance skills to authentic local and global issues.

IS 14: The candidate demonstrates an understanding of assessment systems that aggregate and disaggregate data collected from multiple formal and informal assessment instruments, and supported by various technological resources.

IS 15: The candidate understands how to use assessment data to engage learners in their own growth, document learner progress, inform ongoing planning, instruction, and program development.

IS 16: The candidate works with learners to create inclusive learning environment that support individual and collaborative learning, encourage positive social interaction, active engagement in learning, and self motivation.

IS 17: The candidate demonstrates the competencies necessary to foster active inquiry, collaboration, and supportive interaction to build skills to access and appropriately apply information that supports lifelong learning.

IS 18: The candidate demonstrates an understanding of individual differences and diverse communities by creating inclusive learning environments and educational opportunities that allow for each learner to reach his/her full potential.

2. NSTA 2012 Standards – this course is designed to help candidates meet the following science standards through the 7 assignments in the *Methods* courses:

1. Content Knowledge:

   1a) Understand the major concepts, principles, theories, laws, and interrelationships of their fields of licensure and supporting fields as recommended by the National Science Teachers Association. (*Methods* Assignment 7)

   1b) Understand the central concepts of the supporting disciplines as outlined in the content analysis form. (*Methods* Assignment 7)

   1c) Show an understanding of state and national curriculum standards and their impact on the content knowledge necessary for teaching P-12 students. (*Methods* Assignments 2, 3 and 4)

2. Content Pedagogy:

   2a) Plan multiple lessons using a variety of inquiry approaches that demonstrate their knowledge and understanding of how students learn science. (*Methods* Assignments 4 and 5)

   2b) Include active inquiry lessons where students collect and interpret data in order to develop and communicate concepts and understand scientific processes, relationships and natural patterns from empirical experiences. (*Methods* Assignments 4, 5 and 7)

   2c) Design instruction and assessment strategies that confront and address naïve concepts/preconceptions. (*Methods* Assignments 4, 6 & 7)

3. Learning Environments:

   3a) Use a variety of strategies that demonstrate the candidates' knowledge and understanding of how to select the appropriate teaching and learning activities – including laboratory or field settings - to help all students learn. (*Methods* Assignments 4, 5 and 7)

   3b) Plans include active inquiry lessons where students collect and interpret data in order to develop concepts, understand scientific processes, relationships and natural patterns from empirical experiences. (*Methods* Assignments 4, 5 and 7)

© Copyright Oral Roberts University 2012. All rights reserved.

3c) Plan fair and equitable assessment strategies to analyze student learning and to evaluate if the learning goals are met. Assessment strategies are designed to continuously evaluate preconceptions and ideas that students hold and the understandings that students have formulated. (*Methods* Assignments 4 and 7)

3d) Plan a learning environment and learning experiences for all students that demonstrate chemical safety, safety procedures, and the ethical treatment of living organisms within their licensure area. (*Methods* Assignments 1, 4 and 5)

4. Safety:

4a) Design activities in a P-12 classroom that demonstrate the safe and proper techniques for the preparation, storage, dispensing, supervision, and disposal of all materials used within their subject area science instruction. (*Methods* Assignments 1, 4 and 5)

4b) Design and demonstrate activities in a P-12 classroom that demonstrate an ability to implement emergency procedures and the maintenance of safety equipment, policies and procedures that comply with established state and/or national guidelines. Candidates ensure safe science activities appropriate for the abilities of all students. (*Methods* Assignments 1and 5)

4c) Design and demonstrate activities in a P-12 classroom that demonstrate ethical decision-making with respect to the treatment of all living organisms in and out of the classroom. They emphasize safe, humane, and ethical treatment of animals and comply with the legal restrictions on the collection, keeping, and use of living organisms. (*Methods* Assignments 1 and 5)

5. Impact on Student Learning:

5a) Preservice teachers will collect, organize, analyze, and reflect on diagnostic, formative and summative evidence of a change in mental functioning demonstrating that scientific knowledge is gained and/or corrected. (*Methods* Assignments 3 and 6)

5b) Provide data to show that P-12 students are able 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. (*Methods* Assignments 5 and 7)

5c) Engage students in developmentally appropriate inquiries that require them to develop concepts and relationships from their observations, data, and inferences in a scientific manner. (*Methods* Assignments 5 and 7)

6. Professional Knowledge and Skills:

6a) Engage in professional development opportunities in their content field such as talks, symposiums, research opportunities, or projects within their community. (*Methods* Assignment 1)

6b) Engage in professional development opportunities such as conferences, research opportunities, or projects within their community. (Note: this standard is met by attendance at a professional meeting pertaining to the subject area during the *Methods II* course)

IV. TEXTBOOKS

The pragmatic approach to the problem of a text this semester will be taken and multiple texts will be utilized, as described in the weekly assignments.

© Copyright Oral Roberts University 2012. All rights reserved.

A. Textbook: There is no required textbook. Other resources will be provided as handouts in class.

V. POLICIES AND PROCEDURES

A. University Policies and Procedures

1. Attendance at each class or laboratory is mandatory at Oral Roberts University. Excessive absences can reduce a student's grade or deny credit for the course.
2. Students taking a late exam because of an unauthorized absence are charged a late exam fee.
3. Students and faculty at Oral Roberts University must adhere to all laws addressing the ethical use of others' materials, whether it is in the form of print, electronic, video, multimedia, or computer software. Plagiarism and other forms of cheating involve both lying and stealing and are violations of ORU's Honor Code: "I will not cheat or plagiarize; I will do my own academic work and will not inappropriately collaborate with other students on assignments." Plagiarism is usually defined as copying someone else's ideas, words, or sentence structure and submitting them as one's own. Other forms of academic dishonesty include (but are not limited to) the following:
   a. Submitting another's work as one's own or colluding with someone else and submitting that work as though it were his or hers;
   b. Failing to meet group assignment or project requirements while claiming to have done so;
   c. Failing to cite sources used in a paper;
   d. Creating results for experiments, observations, interviews, or projects that were not done;
   e. Receiving or giving unauthorized help on assignments.

   By submitting an assignment in any form, the student gives permission for the assignment to be checked for plagiarism, either by submitting the work for electronic verification or by other means. Penalties for any of the above infractions may result in disciplinary action including failing the assignment or failing the course or expulsion from the University, as determined by department and University guidelines.
4. Final exams cannot be given before their scheduled times. Students need to check the final exam schedule before planning return flights or other events at the end of the semester.
5. Students are to be in compliance with University, school, and departmental policies regarding the Whole Person Assessment requirements. Students should consult the Whole Person Assessment handbooks for requirements regarding general education and the students' majors.
   a. The penalty for not submitting electronically or for incorrectly submitting an artifact is a zero for that assignment.
   b. By submitting an assignment, the student gives permission for the assignment to be assessed electronically.

B. Course Policies and Procedures

1. Evaluation Procedures

   Course grades will be on a point basis, utilizing a standard grading scale (90-100%=A). The breakdown of course grades is as follows.

   Safety Module 100

© Copyright Oral Roberts University 2012. All rights reserved.

Unifying Concepts	100
Completion and Reflection of Practicum Experience @ 25 points each	50
Service-Learning Project	80
Final Exam (given during final exam week)	50
Total of Course Points	**380 points**

2. ePortfolio Requirements

Any ePortfolio activity required in this course must be completed and assessed prior to the end of the semester to receive course credit; otherwise a grade of zero will be assigned for that assignment. Refer to the College of Education ePortfolio handbook for more information.

a. A copy of the entire safety module that shows the teacher candidates' thorough understanding of safety issues related to secondary science classrooms including ethical treatment of animals, safety contract and plan, a safe lab design, usage of necessary safety supplies and proper handling of biological waste.

b. A copy of the Service-Learning classroom design evaluation prepared for the school evaluated.

c. A copy of the written material expressing the plan for accommodations for included students in the science classroom, for how to express unifying concepts in science, and for how to teach the nature of science effectively.

3. Other Policies and/or Procedures

Assessment of Competencies

a. Thoroughly plan for a safe classroom environment for students, teachers and school by incorporating safety rules and a contract, effectively planning for safety issues, knowing how and being able to teach students how to use safety supplies correctly, practicing ethical treatment of animals, handling biological waste appropriately, etc

b. Design a year's course in a science content area with moderate detail, as measured by instructor evaluation.

c. Develop daily lesson plans for a science unit with great detail, as measured by instructor evaluation.

d. Write broad and specific behavioral objectives that are measurable in both the cognitive and affective domains, as determined by instructor evaluation.

e. Design and execute two or three lessons (depending on class size) on any science content demonstrating the teacher candidate's understanding and ability to teach in a variety of methods, as measured by instructor and peer evaluation.

f. Teach and write sample lessons demonstrating the teacher candidate's ability to use the inquiry method, as measured by instructor evaluation.

g. Write an examination over a science unit, analyze it on a two-dimensional grid with the unit's objectives versus the six levels of Bloom's taxonomy to help determine the effectiveness of the assessment tool, and explain the teacher candidate's own testing policy, as measured by the instructor.

h. Design an evaluation of the Service Learning Project to be given to the school as a means of assisting them in their lab safety and supplies.

© Copyright Oral Roberts University 2012. All rights reserved.

i. Write plans for teaching included students, how to teach the nature of science, and expressing the unifying concepts in science.

VI. COURSE CALENDAR

Week	Topic
1	Introduction to course and expectations; Go over Assignment 1 format and expectations; discuss NSTA and NSES science standards and Common Core Curriculum
2	Go over Flinn Safety issues and tour Biology and Chemistry labs for safety training and safety items checklist
3	**Turn in Assignment 1, Part One – Safety Contract and Assessment;** Go over NFPA Rating system and MSDS applied to lab/classroom setting
4	**Turn in Assignment 1, Part Two – Safety Items, MSDS and Safety Importance and Requirements;** Go over lab design and ethical treatment of animals issues; discuss classroom choices that pertain to safety
5	**Turn in Assignment 1, Part Four – Lab Design and Ethical Treatment of Live Specimen and Natural World**
6	Practicum in local school analyzing lab design, usage and safety curriculum
7	Service Learning Project in a local school
8	Service Learning Project in a local school
9	**Turn in Assignment 1, Part Three – Service Learning Project;** Discuss Inclusion in the Science classroom and lab setting & assign Assignment 7, Part I
10	**Turn in Assignment 7, Part I – Modifications for Unique Learners**; Discuss the nature of science and how true science is distinguished from pseudoscience
11	**Turn in Assignment 7, Part II – The Nature of Science;** Discuss the historical aspects of science curricula in American secondary schools and how that history still impacts our culture
12	**Turn in Assignment 7, Part III – History of Science Education in American Secondary Schools;** Discuss the Unifying Concepts in Science and how that translates to overall science instruction
13	**Turn in Assignment 7, Part IV – Unifying Concepts in Science;** Wrap up the discussion of the course
14	Practicum in local school analyzing lab design, usage and safety curriculum
15	Review and prepare for the final exam.
16	Final Exam

© Copyright Oral Roberts University 2012. All rights reserved.

Course Inventory for ORU's Student Learning Outcomes
Secondary Science Methods – BIO 429
Fall 2014

This course contributes to the ORU student learning outcomes as indicated below:
Significant Contribution – Addresses the outcome directly and includes targeted assessment.
Moderate Contribution – Addresses the outcome directly or indirectly and includes some assessment.
Minimal Contribution – Addresses the outcome indirectly and includes little or no assessment.
No Contribution – Does not address the outcome.

The Student Learning Glossary at http://ir.oru.edu/doc/glossary.pdf defines each outcome and each of the proficiencies/capacities.

OUTCOMES & Proficiencies/Capacities	Significant Contribution	Moderate Contribution	Minimal Contribution	No Contribution
1	**Outcome #1 – Spiritually Alive** Proficiencies/Capacities				
1A	Biblical knowledge			X	
1B	Sensitivity to the Holy Spirit			X	
1C	Evangelistic capability				X
1D	Ethical behavior			X	
2	**Outcome #2 – Intellectually Alert** Proficiencies/Capacities				
2A	Critical thinking	X			
2B	Information literacy	X			
2C	Global & historical perspectives		X		
2D	Aesthetic appreciation			X	
2E	Intellectual creativity	X			
3	**Outcome #3 – Physically Disciplined** Proficiencies/Capacities				
3A	Healthy lifestyle			X	
3B	Physically disciplined lifestyle			X	
4	**Outcome #4 – Socially Adept** Proficiencies/Capacities				
4A	Communication skills	X			
4B	Interpersonal skills	X			
4C	Appreciation of cultural & linguistic differences	X			
4D	Responsible citizenship		X		
4E	Leadership capacity	X			

© Copyright Oral Roberts University 2010. All rights reserved.